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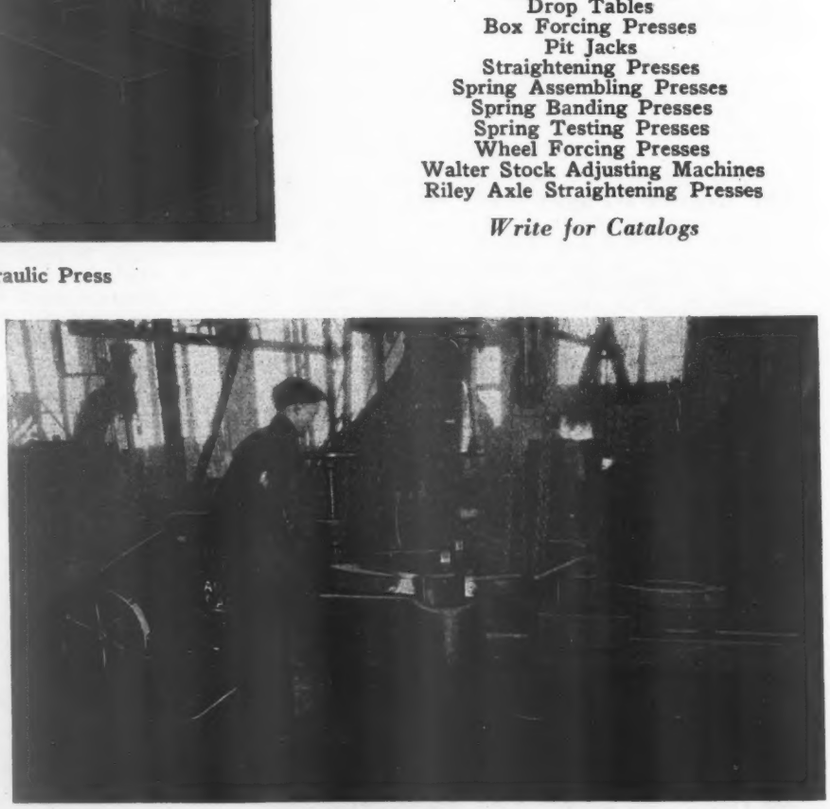

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Railway
Mechanical Engineer

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March - 1932

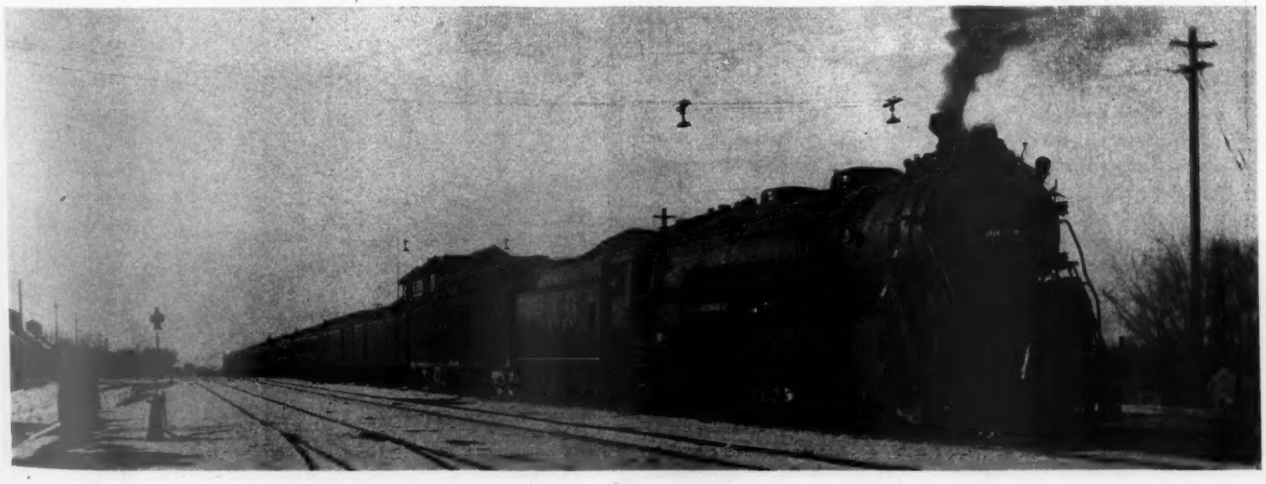
A Hundred Thousand Miles For The Timken Locomotive

Roller-bearing locomotive completes first 100,000 miles of service on 13 roads over 21-month period—Record of operation shows interesting data on performance in both freight and passenger service

THE first steam locomotive to be completely equipped with anti-friction bearings completed its first 100,000 miles of actual road service on January 4, 1932. During a period of 21 months the Timken locomotive has hauled both freight and passenger trains on 13 railroads over a territory extending from Portland, Maine, to Seattle, Wash. During this time it was assigned to the handling of some of America's best known trains—under all kinds of operating conditions; over all kinds of grade and curve conditions; manned by strange crews and maintained by strange terminal forces—a tribute both to the engineering genius of its designers and to the operating ability of railroad men.

The Timken locomotive, during the 21-months' period, has been operated on the following roads in passenger service: Pennsylvania; Chesapeake & Ohio; Erie; New York, New Haven & Hartford; Delaware, Lackawanna & Western; Lehigh Valley; Missouri Pacific; Chicago, Burlington & Quincy, and Northern Pacific. In addition to having operated on the foregoing roads in freight service as well as passenger service, the locomotive was used in freight service only on the following railroads: New York Central; Boston & Maine; New York, Chicago & St. Louis (Nickel Plate); and Chicago & Alton. At the time this article was written the locomotive was still in service on the Northern Pacific. In addition to the actual road service on the above mentioned railroads the locomotive made a trip, light, over the Delaware & Hudson for a total distance of 148 miles.

On January 4, 1932, the Timken locomotive had completed a total of 100,319 miles of road service,



Northern Pacific train No. 2 leaving Jamestown, N. D., on January 18, 1932

51,655 of which was in freight service and 48,664 miles in passenger service. During the period from April 4, 1930, to January 4, 1932, a total of 555 runs in service had been completed, involving the handling of 27,356 freight cars and 2,431 passenger cars.

Timken Locomotive Has Remarkable Service Record

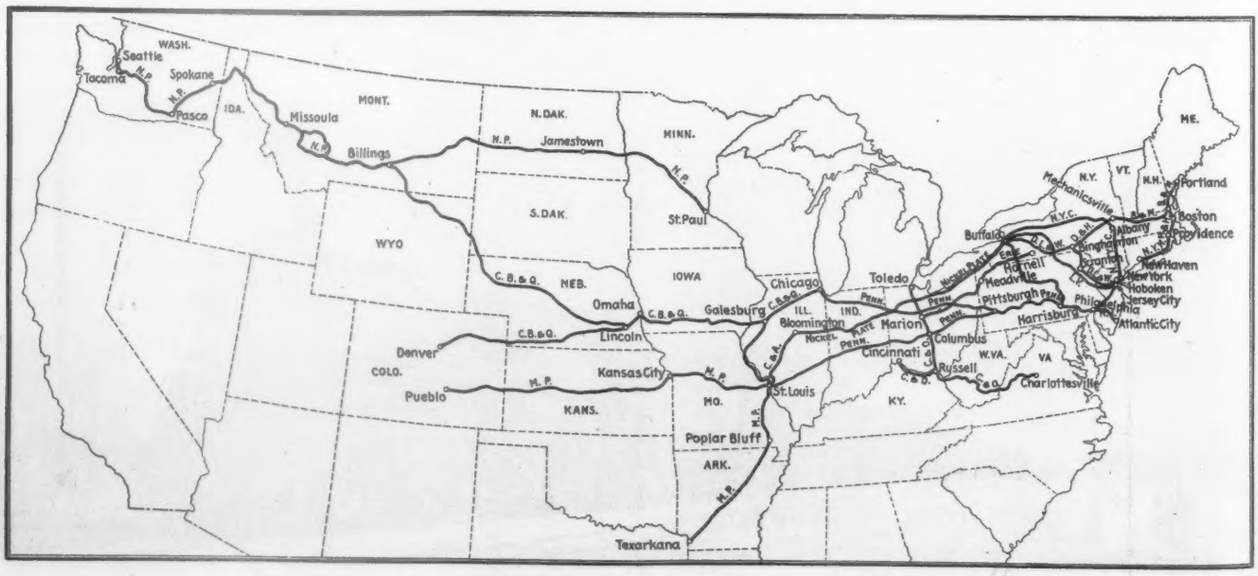
Tables I and II show summaries of all the runs made by the Timken locomotive in freight and passenger service. During the 21-months' period of service the locomotive made a number of remarkable runs. While the locomotive was on the Boston & Maine, on January 24, 1931, with a temperature of 20 degrees below zero, the locomotive covered a distance of 112 miles, handling a train of 86 cars, 3,040 tons, in 194 minutes running time at an average speed for the entire distance of 33.74 miles per hour. The train performance on this run was at a rate of 76,016 gross ton-miles per train-hour and the evaporation, 7.10 lb. of water per lb. of coal.

One particular run on the Delaware, Lackawanna & Western is of interest. On March 11, 1931, while handling train No. 12, the Timken locomotive left Scranton, Pa., 56 minutes late, with a train of 11 cars. The rail was wet and slippery with snow falling. The train had a helper locomotive from Scranton to Lehigh Summit, Pa., a distance of 18.5 miles. Over this district a six-mile grade of 1.67 per cent, compensated, and 12 miles of 1.21 per cent are encountered. The train ran from Scranton to Gouldsboro, Pa., a distance of 20.3 miles, in 33 minutes at an average speed of 37 miles per hour, making up 13 minutes on the mountain. Another 13-minute delay was encountered at Stroudsburg, Pa. Between Stroudsburg and Summit, N. J. the rest of the lost time was made up—the train being on time at Summit, N. J., which is 21 miles out of the terminal at Hoboken, N. J., 69 minutes of lost time having been made up in 113 miles of running. This run was made with nine tons of coal and 12,767 gallons of water. The average evaporation was 5.91 and the coal consumption per passenger car-mile was 12.61..

On October 5, 1931, while in service on the Chicago, Burlington & Quincy, the locomotive handled a train of 122 cars, 6,112 tons, including the locomotive, between Galesburg, Ill. and Ottumwa, Ia., a distance of 117 miles, at an average speed for the trip of 33.3 miles per hour. Train performance on this trip over the C. B. & Q.

Table I—Summary of All Runs in Passenger Service

Road		Pennsylvania	Chesapeake & Ohio	Erie	New York, New Haven & Hartford	Delaware, Lackawanna & Western	Lehigh Valley	Missouri Pacific	Chicago, Burlington & Quincy	Northern Pacific	Totals and averages
No. runs		23	20	28	2	109	11	14	3	17	227
Average running speed, m.p.h.		45.89	38.73	41.56	48.01	39.39	54.83	41.88	45.16	40.34	41.23
Locomotive-miles	Trip	342	339	105	180	138.9	258.1	253	323	451	214
	Total	7,871	7,128	3,058	360	15,140	3,017	3,448	970	7,672	48,664
Train-miles	Trip	341	343	98.5	180	136.7	253.5	243	322	447	209
	Total	7,846	6,872	2,760	360	14,901	2,788.6	3,403.5	967	7,606	47,505
Number of cars	Trip	12.5	8.8	9.8	14	10	11.5	14.5	13.3	10	10.7
	Total	289	177	275	28	1,121	127	204	40	170	2,431
Coal, tons	Trip	16	14	5.7	7.5	8.7	12.7	15.7	20.5	33	11.9
	Total	370	283.5	160.5	15	952	139.5	219.25	61.5	462.9	2,664.2
Water, gal.	Trip	31,651	26,891	11,218	15,550	13,500.6	22,707	24,180	31,100	38,182	19,190
	Total	727,993	537,830	314,120	31,100	1,471,567	249.776	338,515	93,300	534,537	4,298,738
Car-miles	Trip	4,119	2,890	997	2,198	1,384.8	2,887	3,328	4,135	3,703	2,135
	Total	94,744	57,795	27,934	4,396	150,945	31,757	46,586	12,405	51,845	478,407
Average lb. coal per car-mile		7.77	9.68	11.43	6.82	12.57	8.78	9.41	9.91	17.85	11.13
Running time, hours.	Trip	7.43	8.88	2.37	3.20	3.47	4.63	5.71	7.13	8.65	4.79
	Total	170.92	177.62	66.55	6.40	379.18	51.00	79.91	21.39	121.23	1,074.2
Train-hours	Trip	8.61	9.57	.....	3.56	3.78	.....	6.42	8.45	10.64	4.79
	Total	198.10	191.53	.....	7.13	412.59	.....	89.95	25.37	149.02	1,073.69
Average lb. water per lb. coal		8.24	8.00	8.20	8.63	6.46	7.46	6.43	6.32	4.81	6.72



Lines over which the Timken locomotive has operated

was at the rate of 109,000 gross ton-miles per train-hour.

While handling train No. 2 on the Northern Pacific between Missoula, Mont., and Jamestown, N. D., a distance of 906 miles, the locomotive made the run in 25 min. less than the schedule time for the district. On another run between Jamestown and St. Paul, Minn.—346 miles—a distance of 45 miles was made in 47 minutes, hauling 10 cars up a 0.4 per cent grade. On this trip the train left Jamestown 57 min. late and arrived at St. Paul on time. An average speed of 50 miles per hour was made in the course of this run.

Table II—Summary of All Runs in Freight Service

Road*	New York Central	Pennsylvania	Chesapeake & Ohio	Erie	New York, New Haven & Hartford	Boston & Maine	Lehigh Valley	New York, Chicago & St. Louis	Missouri Pacific	Chicago, Burlington & Quincy	Northern Pacific	Totals and averages
No. runs	44	45	8	28	19	35	50	12	15	50	22	328
Average running speed, m.p.h.	28.26	29.64	24.78	27.12	22.99	28.79	36.93	31.70	33.64	34.27	28.0	29.80
Locomotive-miles {Trip	149.5	237.0	117.0	104.3	158.0	120.0	92.0	175.8	261.4	123.0	122.0	152.0
Locomotive-miles {Total	6,582	10,667	930	2,922	3,007	4,193	5,535	2,110	3,921	7,137	3,659	51,655
Train-miles {Trip	146.7	220.0	114.0	102.0	149.0	110.0	89.9	174.1	232.8	122.0	110.1	126.9
Train-miles {Total	6,458	9,911	915	2,856	2,836	3,856	4,495	2,090	3,493	6,094.8	2,422.08	45,427
No. of cars {Trip	103.6	101.0	123	71.5	107.4	80.3	79.8	76.0	79.8	77.8	60.0	83.4
No. of cars {Total	4,561	4,558	984	2,003	2,042	2,813	3,981	913	1,198	3,893	1,323	27,356
Tons per trip {Excl. loco	3,500	3,999	6,391	2,411	3,507	3,067	2,755	2,592	2,885.7	2,828	2,679	3,160
Tons per trip {Incl. loco	3,860	4,354	6,743	2,798	3,844	3,417	3,054	2,947	3,240.7	3,246	3,034	3,516
Total tons {Excl. loco	134,130	179,962	51,126	67,506	66,640	107,354	137,764	31,114	43,286	138,577	58,934	1,036,393
Total tons {Incl. loco	169,840	195,937	53,946	78,356	73,030	119,611	152,730	35,374	48,611	159,078	66,744	1,153,257
Coal, tons {Trip	13.8	22.4	14.3	11.3	16.5	9.9	9.2	17.3	23.9	13.8	15.0	14.56
Coal, tons {Total	608	1,009	115	316	315	347.5	460.5	227.3	358.2	689.75	330.75	4,777
Water, gal. {Trip	22,788	39,596	24,380	20,083	29,966	17,580	14,365	31,964	38,014	20,592	18,294	23,874
Water, gal. {Total	1,002,660	1,781,820	195,038	562,334	569,363	615,294	718,256	383,570	570,220	1,029,640	402,461	7,830,656
Car-miles {Trip	14,381	20,696	14,741	6,864	14,200	8,868	6,945	15,141	17,677	8,872	6,590	11,699
Car-miles {Total	632,753	931,342	117,925	192,194	269,992	310,385	347,274	181,690	265,155	443,634	144,987	3,837,331
G.t.m. per trip {Excl. loco	514,486	807,185	746,069	246,559	512,683	341,984	238,224	470,401	710,087	324,464	283,355	440,321
G.t.m. per trip {Incl. loco	566,865	886,896	786,390	282,808	564,198	381,095	269,479	594,865	795,610	374,193	322,438	491,077
G.t.m. total {Excl. loco	22,637,383	36,323,360	5,968,551	6,903,645	9,740,975	11,969,434	12,808,527	5,644,821	10,296,268	15,898,743	6,233,826	144,425,533
G.t.m. total {Incl. loco	24,942,033	39,910,360	6,291,116	7,918,626	10,719,755	13,338,313	14,600,799	6,387,031	11,536,351	18,335,466	7,093,662	161,073,512
Aver. lb. coal per 1,000 g.t.m. {Excl. loco	53.64	55.50	38.33	91.66	64.36	57.89	77.32	88.43	69.57	86.76	106.11	66.15
Aver. lb. coal per 1,000 g.t.m. {Incl. loco	48.68	50.51	36.37	71.91	58.49	51.95	68.35	76.21	62.09	75.23	93.25	59.31
Running time, hours {Trip	5.19	7.42	4.60	3.76	6.48	3.82	2.52	5.68	6.92	3.56	3.93	4.65
Running time, hours {Total	228.39	334.20	36.76	105.26	123.19	133.93	126.09	68.19	103.78	177.97	86.48	1,524.2
Train-hours {Trip	6.52	10.08	5.50	4.56	10.94	4.58	3.08	7.97	9.34	4.43	5.28	6.12
Train-hours {Total	286.80	453.60	43.98	127.60	207.87	160.28	154.39	95.65	140.23	221.86	116.15	2,008.4
Gross ton-miles per train-hour	78,931	80,078	135,649	54,070	46,686	74,668	78,678	61,032	73,424	71,661	53,670	71,911
Evaporation, lb. water per lb. of coal	6.88	7.36	7.10	7.41	7.56	7.39	6.50	7.02	6.63	6.22	5.07	6.83

* The Delaware, Lackawanna & Western, with 834 locomotive-miles, and the Chicago & Alton with 158 locomotive-miles in freight service, are omitted from the table, as performance details are not available. The mileages, however, are included in the total.

Principal Features in the Design of the Timken Locomotive *

The engine-truck and tender-truck roller bearings on the Timken locomotive are of a type that have been developed as a result of over four years of experience in locomotive service. In some cases, on locomotives equipped with these bearings on the engine trucks only, the service mileages are up in the neighborhood of 500,000.

The driving-wheel bearings on this locomotive are of a type having a single row of rolls adjacent to each wheel. Both bearings are mounted in a one-piece housing extending across the frame, the axle unit thus comprises the axle and wheels, bearings and housing, assuring the absolute maintenance of alinement between these respective parts, irrespective of the condition of the rails and the oscillation of the locomotive frame. Inasmuch as the application of roller bearings to driving wheels demands the maintenance of a high degree of accuracy as regards axle tramming and side-rod spacing the use of adjustable features such as used in plain-bearing locomotives is precluded. This necessitated a radical departure from the conventional in the design of the pedestal arrangement.

An underlying fact controlling this design is the wide discrepancy between the capacity of the roller bearings on the axles and the plain bearings on the crank pins

* A complete description of the Timken Roller Bearing Locomotive was published in the *Railway Mechanical Engineer* for June, 1930, page 316.

Timken locomotive in freight service on the Pennsylvania

involving a condition whereby the wheels being off tram would impose destructive extraneous loads on the wheel and rod bearings. In designing this locomotive no fear was felt for the roller bearings on the axles but rod bearings lack the capacity to stand extraneous loads of this nature. The traditional shoe and wedge construction could be built accurately to close measurements as far as tram is concerned. The adjustment of wedges, over a period of years, however, might lead ultimately to off-tram conditions. It was therefore considered advisable to construct the pedestal faces with parallel sides and line the bearing housings with hardened-steel liners which contact directly with the hardened-steel trunnion guides. The pedestal liners are steel—the complete construction comprising a hardened-steel mechanism which takes the reactions of the piston thrust.

The trunnion guides are hardened channel-shaped forgings and are flexibly mounted on trunnions which are integral with the bearing housing. The trunnion guides are free to pivot on this trunnion and thus maintain a full surface contact with the pedestal liners without the hour-glass machining of the bearing housings. The trunnion-guide construction which is used on the Timken inboard bearing housings on engine trucks and drivers has been in actual service for over four years, and has been or will be applied to over 350 locomotives in operation or on order.

Aside from the application of anti-friction bearings on this locomotive, one of the high spots of its construction is the generous use of nickel-alloy steels throughout its design, there being about 100,000 pounds of this material in it. Among the principal items, aside from the Timken bearings, which contain 5 per cent nickel, are the boiler shell, firebox sheets, combustion-chamber and throat sheets and Thermic syphons all of which contain 2 per cent nickel; the main frames and crossheads; the main rods and side rods, each of which are 2¾ per cent nickel alloy; the cylinder liners and valve bushings which are 1 per cent nickel cast iron, and the trunnion guides with a nickel content of 4 to 5 per cent.

The lateral motion device on No. 1 driving wheel is used to facilitate operation on roads with 20-degree curvature. This limits the rigid wheel base to 12 ft. 10 in., whereas the driving wheel base is 19 ft. 3 in. The lateral motion on either side of the neutral axis is against fixed spring resistance and on leaving curves is automatically returned to the neutral axis.

The lateral motion on the leading trailer axle is of the roller inclined-plane type. This serves the two-fold purpose of complying with all I.C.C. regulations concerning uncontrolled lateral motion on locomotive axles and it imposes on the leading trailer axle a certain duty in guiding the locomotive on curves, thereby relieving the rear trailer axle to a corresponding extent. It is quite possible that the exceptionally smooth riding qualities of this locomotive may be traced directly to this definite guidance on all of the wheels. In connection with the general study of relief of excessive strain on entering and leaving curves, the spread of the front and back driver tires is made ⅛ in. narrower than the main and back intermediate wheels. Therefore, all the wheels on the locomotive carry their normal proportion of flange thrust reactions on curved track.

There are no thrust plates anywhere on the Timken locomotive. The thrust reactions on the leading truck, driver, trailer and tender are taken directly on the rolling surfaces of the tapered bearing. The taper construction of the bearing takes this thrust reaction without any additional mechanism, and, inasmuch as the thrust is taken on lubricated roller-bearing surfaces the loss is said not to be over one-twentieth of one per cent, or about one pound per ton. The lateral motion that was built into the locomotive is maintained throughout the life of the bearings. In the 100,000 miles which the Timken locomotive has operated to date there has been no appreciable change in this lateral. The net result of

Table IV—Performance of Main- and Side-Rod Bushings

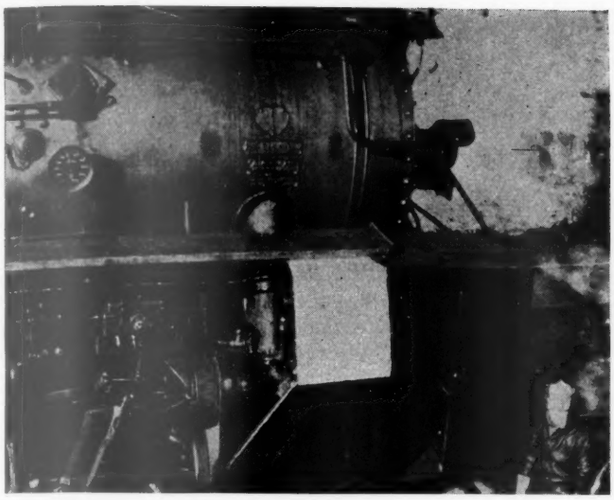
	Back-end main		Main side rod		Front wheel		Back inter.		Back wheel	
Mileage	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
146	....	....	....	....	....	....	....	....	(1)	....
1,462	(2)	....	....	....	....	....	....	....	....	....
2,192	....	....	....	....	(1)	....	....	....	....	....
6,582	....	....	....	....	(4)	(4)	(4)	(4)	(4)	(4)
42,010	....	....	....	(3)	....	....	....	....	....	....
64,653	(3)	(3)	(3)	....	....	(3)	(3)	....	....	....
64,740	(5)	....	(5)	....	....	....	....	....	....	....
65,658	(6)	....	....	....	....	....	....	....	....	....
69,029	(6)	....	....	....	....	....	....	....	....	....
69,129	....	....	(6)	....	(7)	(7)	(7)	(3)	(7)	(9)
69,651	....	....	....	....	(7)	....	(7)	....	....	....
73,416	(7)	....	....	....	....	....	....	....	....	....
73,526	....	....	....	....	(7)	....	....	....	....	....
80,146	....	....	(8)	(10)	(8)	(10)	(8)	....	....	....
82,139	....	....	....	(6)	....	....	....	....	....	....
83,145	....	(6)	....	....	....	(6)	....	....	....	....
100,319	Record ended; all bushings still in service.									

Maximum mileages for any one bushing application:
63191 64653 64653 42010 62547 58071 58071 62547 62547 62547

Reasons for Renewing Rod Bushings at Mileages Indicated Above
(1) Not enough lateral
(2) Not enough diameter clearance
(3) Diameter wear
(4) Changed from fixed to floating bushing
(5) Experimental Construction
(6) Defective casting
(7) Bushing cracked
(8) Main crank pin broke
(9) Bushing broken
(10) Damage as result of right main pin breaking

Table III—Pints of Oil Used on Timken Locomotive

		Bearing Location and Number																										
		Tender												Trailer				Driver								Engine truck			
Railroads	Oil	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Pennsylvania	Added	2	1½	..	..	2	2	..	1½	2	1½	..	1½	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Changed	9	9	9	9	9	9	9	9	9	9	9	9	26	26	20½	20½	24½	24½	24½	24½	24½	24½	24½	24½	9	9	9	9
New York Central	.....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chesapeake & Ohio	Added	..	..	..	..	..	5	..	..	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Erie	Added	4	9	4	..	4	..	..	..	4	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Changed	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	24½	24½	24½	24½	24½	24½	24½	24½	..	..	..	..
New York, New Haven & Hartford	Added	4	2	4	3	3	2½	4	2½	3	2½	4	2½	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Boston & Maine	.....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Delaware, Lackawanna & Western	Changed	9	9	9	9	9	9	9	9	9	9	9	9	26	26	..	..	24½	24½	24½	24½	24½	24½	24½	24½	9	9	9	9
Lehigh Valley	Added	2½	.	2	..	3	..	3	3	..	3	3	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
New York, Chicago & St. Louis	.....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chicago & Alton	.....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Missouri Pacific	Added	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	5	..	..	..	..	..	..
Chicago, Burlington & Quincy	.....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Northern Pacific	.....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..



Test equipment on the front end of the Timken locomotive

this design and construction is the elimination of surging at low, medium and high speeds—the latter term having reference to speeds of 70 to 85 m.p.h.

Oil loss is avoided on tracks with high super-elevation in the following manner: The trailer and tender axles have outboard bearings with independent housings for each wheel. The engine-truck and driving-wheel bearings have one-piece housings but the bottom part of the housing is deepened at both ends to provide independent cavities for each bearing. The depth of the oil cavities is sufficient to avoid any loss of oil from one side to another at high super-elevation.

Valve oil is used for the lubrication of all roller bearings. The housings of the various bearings have the following oil capacities for each wheel:

Engine truck	9 pints
Drivers	24½ pints
Leading trailer	10 pints
Rear trailer	16 pints
Tender trucks	9 pints

In 21 months of service a total of 1,125 pints of lubricant has been used on the various roller bearings. Of this total 104 pints have been lubricant that has been added from time to time, the remaining 1,021 pints having been involved in complete oil changes. Table III shows the amounts added and the details of oil changes on the several roads over which the locomotive operated during the period mentioned.

The Question of Maintenance

As far as the roller bearings on the Timken locomotive are concerned there has been no maintenance during 100,319 miles of service except that of the normal inspection and lubrication. In spite of the fact that the driving wheel bearings receive the identical piston thrust to that taken by the rod bearings multiplied by the leverage due to the overhang of the crank pins over the wheel bearings and, in addition, carry their proportionate weight of the locomotive on drivers, the original roller bearings after 100,000 miles of service are in excellent condition. No repairs have been made during that term of service. Aside from lubrication inspection and servicing no adjustments of any bearing have been necessary except on the main drivers. In this case it was found that one of the bearing cups (the outer roller raceway) had seated itself into the bearing housing which necessitated pressing on one of the driving wheel centers 1/32 in. This bearing shows no indications of wear. The condition which made this seating of the bearing cup in the housing possible has been corrected in subsequent designs.

It was expected that the pedestal liners would show some wear. That which has resulted after 100,000 miles of service is surprisingly small. On the front and back drivers the wear has been negligible. The main and intermediate pedestal liners developed a total of 1/32 in. looseness and the liners have been renewed. Experience so far has indicated that improved lubricating conditions will prolong the life of the pedestal liners and trunnion-guide surfaces.

Experience to date with the Timken locomotive while handling heavy trains on fast schedules has indicated that the rise in temperature of the roller bearings varies from 15 deg. above atmospheric temperature on the front, intermediate and back driving wheels to 30 deg. above atmospheric temperature on the trailer wheels. The main drivers have shown a maximum rise of 20 deg. above atmosphere. These temperatures are contrasted with increases in temperature on the side-rod bearings of from 100 to 350 deg. above atmosphere and on the back-end main-rod bearing of from 200 to 400 deg. Some indication of the actual temperatures at several of the bearings may be seen in one of the illus-

The end of the first 100,000 miles

Locomotive No. 1111 arriving at Jamestown, N. D., after hauling Northern Pacific Train No. 1 from St. Paul, Minn. Charles York, engineman, is standing on the steps and behind him, fireman Philip McManus. Road foreman W. J. Ridley is on the ground.

trations which shows snow and ice on the bearing housings after a long passenger run on the Northern Pacific.

When the Timken locomotive was first placed in service there was a decided interest on the part of railroad men in the performance of the main- and side-rod bushings because of the fact that these parts have been the source of much trouble in locomotive operation and maintenance. It was confidently expected by the designers that the application of roller bearings to the driving wheels would have an important influence on the performance of plain bearings on rods. In the first 100,000 miles of service the record seems to indicate that an improvement may be expected as a result of the relative rigidity of construction due to the roller bearings on the driving wheels. The absence of driving-box pounds seems to have had a favorable influence on the rod bushings. The record in Table IV shows the service rendered by the rod bushing.

Performance of Main- and Side-Rod Bushings

Shortly after the locomotive was placed in service it was found necessary to change the back-end main-rod bushing, right side; the right front side-rod bushing and the right back side-rod bushing due to their having insufficient lateral in two cases and insufficient diameter clearance in the third instance. At 6,582 miles the fixed bushings on the front, back and intermediate wheels on both sides were removed and replaced by floating type rod bearings. These bearings consisted of a "Timken Steel hardened" liner press-fitted into the rods. A three-piece floating bronze bushing operates between the hardened steel liner and the nickel-steel crank pin. The outside diameters of the floating bushings are crowned and the hardened steel liners reverse crowned to match, the radius being approximately equal to the spacing between the drivers. This creates a self-alining bearing which apparently distributes the load over the entire surface of the crank pin.

After 42,010 miles of service it was necessary to renew the left side-rod bushing at the main pin due to diameter wear. At an accumulated mileage of 64,653, renewals were made for the same reason on both right and left back-end main rod bushings, right side-rod bushing at the main pin, left front side-rod bushing and right intermediate side-rod bushings. At this time the right and left back-end main-rod bushings had given 63,191 and 64,653 miles, respectively, of uninterrupted service. The latter mileage was also obtained from the right side-rod bushing at the main crank pin. At about this period an experimental type plain bearing construction was applied at the main crank pin, right side, on both the main and the side rod. This, however, did not prove satisfactory and was removed after 87 miles of service. During the next 8,800 miles of service defective bushing castings required the renewal of three bearings, cracked bushings required the renewal of eight bearings and a broken bushing made necessary the renewal of one bearing.

When the locomotive had been in service 80,000 miles the right main crank pin ran hot on one trip which was responsible for setting up a fracture that resulted in a broken crank pin. This accident required the renewal of the bushings in the right side rod at the main pin, the front side-rod bushings on both sides and the right intermediate side-rod bushing. During the last 20,000 miles of service defective castings required the renewal of three more bearings.

In spite of the necessity of making rod-bushing changes 38 times during the 21 months the locomotive has been in service, satisfactory mileages for bearing performance have been obtained. One bushing ran 42,000 miles, two more ran 58,000 miles and at the remainder of the bearing locations mileages of 62,000, 63,000 and 64,000 have been obtained. It seems that the roller-bearing driving box construction exerts a favorable influence on rod-bushing performance when it is considered that these mileages exceed present averages on roads having locomotives of similar size.

Influence of the Roller Bearings on Other Factors of Design

Due to the relative absence of vibration and the elimination of shocks due to the pounding of worn driving-box bearings there has been a noticeable absence of loose bolts on this locomotive and because of the fact that there have been no loosened pipe clamps the maintenance of piping has been considerably less than would ordinarily be the case with a plain-bearing locomotive.

Ice on the driving-wheel hubs and spokes adjacent to the hubs at the end of a fast passenger run indicates the low bearing temperatures

No loose or broken piping or connections have been experienced thus far.

The use of roller bearings on axles precludes journal wear and the life of the axle is increased considerably, being limited by the minimum wheel-fit diameter. The increased high speeds and bearing pressures on plain bearings, particularly on driving axles, has introduced thermal checking which often leads to ultimate axle failure.

The absence of thrust plates on all the wheels should eliminate the occurrence of heat-checked wheel hubs. This condition is prevalent on engine-truck wheels and the use of roller bearings obviates this expense of wheel replacement. Furthermore the roller-bearing application permits the use of tender wheels which have a more desirable hub section on the engine truck instead of the usual engine-truck wheel with its heavy section forming a bearing surface.

It may be possible, as a result of this smoother operating mechanism to decrease boiler maintenance.

What Fuel Should Railroads Buy?*

By H. C. Woodbridge

The growing market for small coal for pulverizing and for use in stationary power plants suggests the possibility of advantageously using plus 1½- to 2-in. coal for stoker locomotives, with a resulting reduction in stack losses and in the cinder nuisance

LOCOMOTIVE boiler performance has been so improved that it now compares favorably in efficiency with the modern stationary boiler. Improvement has been accomplished principally by the almost universal installation of superheaters and brick arches in old as well as in new locomotives; by the extensive use of feedwater heaters; by the introduction of greater furnace volume and firebox-heating surface, as well as increased grate surface, in new locomotives; by the rapidly extending use of grates with individual air-inlet openings as small as practicable, and with total aggregate air-inlet opening so restricted that excess air is reduced approximately to the minimum consistent with good operation.

The more efficient boiler, accompanied by substantial improvement in the construction of locomotive machinery, has justified long runs, thus greatly reducing standby fuel losses. Improvements in valves and valve setting and the use of limited cut-off, steam-chest and back-pressure gages and the other indicators, such as pyrometers, pilot valves, etc., have combined to improve locomotive operation.

The stoker, by making possible the operation of large locomotives at maximum drawbar horsepower for hours has contributed essentially to progress in transportation. Such developments, accompanied by increased carrying capacity per car, reduction in grades, installation of modern signaling, additional trackage, reduction in delays accomplished by superior make-up and dispatching of trains, the education of engine crews and marked improvement generally in fuel furnished, have resulted, during the past 10 years, in a 30 per cent reduction in pounds of fuel per thousand gross ton-miles in freight service; namely, from 197 lb. in 1920 to 138 lb. in 1930. In passenger-train service, with considerable increase in average weight per car, the fuel consumption per passenger train car-mile was reduced during the same period 21 per cent, or from 18.8 lb. in 1920 to 14.7 lb. in 1930, and there was a further reduction in fuel used per unit of service during the first six months of 1931.

The average cost of this fuel during the years 1920 to 1930 was lowered from $4.20 to $2.34 per ton, or 44 per cent.

Has any other great industry survived a reduction of 30 per cent in demand per unit of work performed, accompanied by a 44 per cent reduction in price per unit delivered, in dealings with its best customer and largely dependent associate?

"We accept rain from the heavens as an act of God. It seems that with the same complacency we are accepting the rain of cinders from many thousand locomotives with a direct loss of some 8 to 20 per cent in coal fired."

Mines and Railroads Have Similar Problems to Solve

In the electrical industry there were produced 303 kw.-hrs. per ton of coal used during the year 1902; in 1928 there were produced 1,135 kw.-hrs. per ton of coal used, an almost 400 per cent destructive change so far as the coal producers and railroads are concerned. And, simultaneously, the oil and gas industry, in its desperate endeavor to provide outlet for ill-advised over-production, has made colossal expenditures for pipe lines which have been used recently to transport fuel to points of consumption where it has been sold at less than cost. The use of oil burners in the United States increased from 12,000 in 1921 to over 600,000 in 1930.

The coal industry has suffered exhaustively as, for various reasons, the railroads are now suffering, and with approximately the same mammoth investment in facilities for transporting coal as there is in coal properties and facilities for mining, preparation of and loading coal. There can be no plausible excuse for failure of these two basic industries to co-operate wholeheartedly.

That the railroads would effect substantial economy in fuel if their locomotive coal supply were plus 1½ or 2 in. when shipped from the mines, there is no question. The direct gain in fuel performance would certainly more than offset the necessarily increased cost as compared with the cost of mine run, and the resultant increased operating efficiency and satisfactory service, including reduction in cinder and smoke loss frequently accompanied by damage or injury cost and public ill will, would further augment the direct profit on such investment.

And of vital importance to the railroads, by confin-

* Abstract of a paper presented at the Third International Conference on Bituminous Coal, held at the Carnegie Institute of Technology, Pittsburgh, Pa., November 16-21, 1931, by H. C. Woodbridge, manager, Railway Service Department, Rochester & Pittsburgh Coal Company, Rochester, N. Y. Associated with Mr. Woodbridge in the preparation of this paper was C. P. Dampman, supervisor fuel conservation, Reading Company, Philadelphia, Pa., and Malcolm Macfarlane, general fuel inspector, New York Central, New York.

ing the greater portion of their locomotive requirements to the plus 1½ or 2 in. coal, the mine operators would be obliged to promote commercial use for essentially the same amount of the smaller sizes, thus furnishing additional traffic for the railroads. The use of these smaller sizes as powdered fuel and in stationary stoker-fired boilers has increased materially during recent years and extensive expansion of its use in this field depends upon the ability of coal operators to produce it without continued loss.

I submit that there are wonderful opportunities for direct profit and substantial development of railroad business awaiting the exercise of broad vision on the part of those directing purchases of railway fuel.

Good Coal Required by Modern Locomotives

The elimination of "fines" from coal for use on locomotives is desirable because of the heavy draft to which all locomotive fires are necessarily subjected in order to burn the 150 lb. of coal frequently required per square foot of grate surface per hour. Universally, such fires are fed from above either by stokers or hand shovels, the plane of delivery being well above the grates and at a level where the intensity of draft is rapidly approaching its firebox maximum and a large proportion of the fine particles of coal which are scattered in delivery through this plane usually will be carried over the arch and out through the flues.

With small particles eliminated, the resultant coal is carried to the fire bed by its own weight where it becomes plastic, cokes and burns and, in the disintegration accompanying the process of combustion, the particles thus formed are in the plane of least draft intensity and, therefore, are very much less likely to be carried over the arch than particles injected into the draft at higher level where the velocity of the draft stream is at least twice that immediately above the fire bed.

The distillation of gases from fine particles is much more rapid than from coarser pieces and the probability of banking increases when a fire is crowded with a preponderance of fines. Smoke elimination is, therefore, more difficult with slack than with the larger sizes.

Slack coal is lost by being blown off cars and locomotive tenders, by leakers from cars and coal chutes, by falling through grates when preparation to fire up is being made, and by falling so far into the ashes on the grates when the fire is being built up that some of it does not ignite.

The popular and efficient perforated grates, or the several designs of grates which provide many small air inlets well distributed over the grate surface, have reduced materially such ashpan loss as compared with the loss sustained when finger or table grates with larger openings are used, but a large quantity of fine coal can fall through seven thousand holes ½ in. in diameter and, in order to obtain 20 per cent air opening in a grate surface of 90 sq. ft., it is necessary to have approximately seven thousand holes ½ in. in diameter, plus the necessary clearances between individual grates and grate frames.

In Canada and the United States there are approximately 55,000 coal-burning locomotives, more than 12,000 of which are equipped with stokers. As these stoker-equipped locomotives constitute a substantial proportion of the modern, high capacity units used in the transportation of both freight and passengers, it seems appropriate to include in this presentation the conclusions arrived at after extensive investigation as to the most suitable coal for stoker-fired locomotives. Such conclusions, with brief comments, are as follows:

It is important that the coal supply in the tender of a locomotive be such that it will feed to and be handled by the conveyor screw of the stoker without attention or labor on the part of the fireman. This makes advisable the use of sized coal, the maximum dimension of any piece being preferably about 3 in., but not more than 8 in., to provide against any interruption in the flow of coal through the stoker mechanism from the tender to the firebox. Of almost equal importance in this particular is the proportion of fines, as a tender load of coal containing a considerable proportion of moist slack will often fail to feed into conveyor trough without manual assistance.

As to the ideal minimum size of coal for use on stoker-fired locomotives, the consensus of opinion is conclusive that the best results will be obtained if all coal which will pass through a ¾-in. shaker screen is removed from the locomotive stoker supply. The reasons for this restriction are not only to insure the desired reliability of flow through the stoker, but also to reduce the percentage of fines discharged into the firebox with smoke and cinder nuisance incident thereto and to make it possible, within good practice, to maintain a satisfactory body of fire.

In the preceding paragraphs effort was made to indicate the ideal and not unobtainable requisites. It is possible, and under certain circumstances may be advisable, to use lump, slack or mine-run on locomotives which are fired by hand or with stokers now in use. But railway officers should consider more thoroughly the cost of operation, the value of efficient and satisfactory service, and the possible benefits to be derived from co-operation with coal producers.

Selection of Stoker Is Important

The above dissertation relative to coal for locomotive stokers would not approach completeness without a few words on such mechanisms. Adequate as such appurtenances have been in making possible the capacity operation of modern high-power locomotives, material reduction in the crushing and grinding of coal in the stoker has awaited recent developments. In obtaining the maximum possible economy in fuel and reduction in smoke and cinder annoyance and costs, the selection of a stoker is almost, if not quite as important as the selection of coal, the superior performance possible with sized coal being largely defeated when a high percentage of such coal is ground into slack by the stoker and its distribution within the firebox inefficiently controlled.

"The selection of locomotive fuel on results of laboratory analysis alone may result in expensive and ill-advised contracts. The characteristics of burning may often prove to be of greater importance in the selection of the most suitable fuel than its analysis."

The elimination of fines from coal delivered by a locomotive stoker is particularly desirable because of the thin layer of fire through all parts of which the draft passes freely, such thin layer of fire being essential to efficient locomotive stoker operation. There should be no banking in a stoker fire.

We accept rain from the heavens as an act of God. It seems that with the same complacency we are accepting the rain of cinders from many thousand lo-

comotives with a direct loss of some 8 to 20 per cent in coal fired.

Laboratory Analysis Does Not Always Insure the Right Coal

To select locomotive fuel on results of laboratory analysis alone may result in expensive and ill-advised contracts. The characteristics of burning may often prove to be of greater importance in the selection of the most suitable fuel than its analysis. To illustrate, the writer had considerable experience in locomotive service with one western coal analyzing approximately 18 per cent volatile, 66 per cent carbon, 16 per cent ash, and 12,500 B.t.u., which coal was utterly inefficient, apparently because the carbon did not burn readily at the attainable firebox temperatures, the ash containing from 30 to 40 per cent carbon. Perhaps the carbon content of this coal was too dense or lacked the necessary impurities essential to easy ignition, the variations in chemical compounds of carbon being responsible for the difference in combustion characteristics.

Recently, I witnessed a series of carefully conducted road tests in which coal analyzing 33 per cent volatile, 57 per cent carbon, 8.85 per cent ash, 13,875 B.t.u. consistently evaporated approximately 18 per cent more water per pound of coal than was evaporated on corresponding alternate day runs with coal analyzing 31 per cent volatile, 61 per cent carbon, 7.20 per cent ash, and 14,360 B.t.u. The same locomotive was used and tonnage per train and operating conditions were practically identical on all runs, the better performance of this lower heat-value coal being apparently due to its slightly firmer structure, a smaller percentage of fines and less flashy conflagration in spite of the two per cent greater volatile, with greater, yet thoroughly porous body of ash and fire on the grates. This same coal showed the highest average steam pressure during extensive tests of eight high-class eastern coals, several of which were superior from a chemical standpoint.

High B.t.u. content is, of course, desirable, but a few hundred heat units per pound often may be sacrificed advantageously if structure and burning characteristics are superior in a coal of somewhat lower B.t.u. content.

Frequently producers claim and consumers demand that ash content should and must be at the irreducible minimum, the lower the better. At least two of the most distinguished fuel economists and authorities on railway fuel in this country have repeatedly directed attention to the loss entailed by hauling ash content from mines to points of consumption, and to the improper or incomplete combustion and heat losses directly chargeable to ash in coal supply. I do not question their conclusions, so far as altogether extraneous matter is concerned, but a reasonable percentage of inherent ash in addition to thin layers of high-ash binder often serve to delay combustion satisfactorily to provide an essential body of fire and thus to diffuse and heat the air currents and make more nearly complete the union of oxygen and combustible elements throughout the firebox, preventing at the same time large streams of cold air at any locality.

Usually, with fires of extremely low-ash coal in modern locomotives you will have either excessive smoke and excessive loss through the safety valves, or a portion of the grates will be uncovered and much of the heat generated will be absorbed by the excess air admitted through the uncovered grates. The fireman, in attempting to balance these extremes, goes approximately from one to the other, with consequent variation in steam pressure and without obtaining the logical results from such chemically superior coal.

The ash should have fusion temperature as high as consistently obtainable, preferably not less than 2,500 deg. F., in order that clinkers will not be formed and to assist in avoiding honeycombing on and in the flues. Analysis of the ash, to determine the percentage of calcium, aluminum and iron oxides, often may be more desirable than to determine the total quantity of ash. Sometimes volume and character rather than weight of ash must be considered.

Effect of Moisture

Also, from a purely chemical standpoint, water in or on the coal as fired absorbs uselessly some of the heat generated by combustion of that coal, but many test-plant runs while the locomotive was working at or near capacity have shown increased evaporation in the boiler per pound of coal burned when the coal was quite thoroughly wet. Much road experience confirms such findings, the generally accepted reason for improvement being that the moisture makes the fine particles adhere to each other or to the lumps and thus reach the fire bed, become plastic, coke and burn, which particles otherwise in great quantity would have passed over the arch through the flues and out the stack practically unburned.

While low-volatile (17 to 25 per cent) coals may be used advantageously in suburban or switching service where drastic smoke-restriction regulations are in effect, the preponderance of fines in low-volatile bituminous coals and their slow ignition and burning features make their use in heavy service, particularly on stoker-fired locomotives, generally unsatisfactory.

High-volatile bituminous coals, always of comparatively hard structure, when suitably sized as fired are advantageous in some particulars as locomotive fuel, because such coals ignite quickly and burn freely. But compliance with smoke regulations becomes increasingly difficult as volatile content rises, and in the selection of coal the fact that the heat value of the volatile content varies should be kept in mind. While hydrogen has four times the heat value of carbon, the variations in heat value of volatile are due principally to the varying quantities of oxygen content, ranging in the eastern United States from 1.8 to 10.24 per cent. Such a considerable portion of this oxygen is combined with carbon as CO or CO_2 that the total B.t.u. content of the coals in question have a maximum variation of 1,290 B.t.u. per pound.

During the past three months I rode several hundred miles on a thoroughly modern locomotive equipped with one of the latest and most efficient stokers, burning coal with from 39 to 42 per cent volatile content without smoke while the engine was working. However, if consistently available, medium volatile coals of reasonably firm structure should be selected for locomotive use, as such coals burn rapidly enough and maintain the desired body of fire while standing or drifting without causing excessive loss through the safety valves. With such coals undesirable smoke can be eliminated easily, which elimination is practically impossible with the high volatile coals while the locomotive is standing or drifting and also difficult while running.

After experiment and experience has indicated the available coal best suited for the service in question, periodical analysis to assist in maintaining quality is necessary, especially when the coal is obtained from non-progressive or irresponsible producers. From the viewpoint of those in charge of locomotive operation it is unquestionably advisable to avoid frequent changes in heat value, burning characteristics or sizing of coal furnished to any particular service. The grates, air in-

lets, draft induction features and human elements involved cannot be adjusted for most efficient service with varying fuel supply.

Co-operation or reciprocity dealings with shippers, while inevitable and within reasonable limits justifiable, should be so handled that those in charge of locomotive design, maintenance and operation are not kept in confusion because of varying characteristics of the coal furnished.

Coke and Oil

Evidently coke should not be considered as locomotive fuel while its domestic use is increasingly so satisfactorily and the market for some of the other products of distillation is so unremunerative. However, with the return to normal conditions it is quite possible that coke may replace anthracite or extremely low-volatile bituminous coals on locomotives in suburban or switching service in congested districts, and its use as railroad station fuel should increase.

Fuel oil is almost ideal as a heat-producing medium for the steam locomotive and where reliability of supply is assured, where reciprocity with shippers justifies its use, and where the price for three and one-half barrels of oil is equal to the price of one ton of bituminous coal it will be used instead of bituminous coal.

Sub-Bituminous Coals

As of interest to bituminous and coal producers and users, extensive tests and continued use in regular service have shown that sub-bituminous coals with an average (of sixty samples) analysis as fired of moisture 24.59 per cent, volatile 29.54 per cent, fixed carbon 37.61 per cent, ash 8.26 per cent, sulphur 0.62 per cent, B.t.u. 8,856, will maintain maximum steam pressure satisfactorily in modern locomotives in heavy service. The amount used, however, is proportionately greater, as the heat content is less than in other coals.

There must be some loss in handling the extra moisture, but those who have had extensive experience in the use of sub-bituminous coals on locomotives assure us that apparently they obtain the same results per B.t.u. in the sub-bituminous as in the bituminous coals of higher heat content.

To handle sub-bituminous coals satisfactorily, the size of each opening through the grates must be as small as practicable—⅜ in. to ¾ in. in diameter at the grate surface. The perforated grates with truncated cone-shaped holes, having a grate surface diameter of ½ in., are preferred by the Northern Pacific which uses more than a million tons of sub-bituminous coals per year on its locomotives. In comparison of performance made with ½ in. round holes in one set of grates, with total opening area of 13 per cent and with ¾ in. round holes in another set of grates having total opening area of 17 per cent, the performance was more efficient and satisfactory with grates having smaller holes and smaller aggregate air opening.

The fact of interest in this item is that enough sub-bituminous coal (more than 200 lb. per sq. ft. of grate surface per hour) can be burned in the modern locomotive firebox to produce sufficient steam for maximum requirements.

Preparation

Progressive coal operators by obtaining and analyzing drill cores in advance of the mining and thus guiding the headings into the better sections, by making seam analyses regularly at frequent intervals, by efficient instruction and supervision of miners, by installation of suitable screens and picking tables and washing or air-cleaning facilities, supplemented by frequent analysis of coal as loaded at the tipple, have insured high quality in the product of their mines. But sometimes track spikes, cutting tools, coupling pins and other pieces of iron are shipped with the coal. More than 50 mine operators on the New York Central Lines have installed electro-magnets at advantageous locations between the mine-car dump and the loading boom, which remove such foreign metal satisfactorily.

Reliable coal producers see to it that cars are thoroughly cleaned before loading, but as the coal car, loaded or empty, is frequently used as a depository for broken brake shoes, bolts or other tramp iron, it has been found expedient to install magnets in railroad coal chutes.

These magnets are often placed above the apron used to conduct coal from the chute to locomotive tenders. The New York Central developed and has installed such magnets in ten of the principal coaling stations on its lines, with the results that obstructions in their stokers are rarely encountered.

We view with pride the marvelous developments in railroad transportation. Equally impressive developments have been made by the 20 per cent of our bituminous coal operators who are responsible for 80 per cent of our bituminous coal output.

Bituminous coal still constitutes the largest item of railroad tonnage and revenue. It is vitally important, therefore, to the railroads that bituminous coal continue to move freely in increasing rather than decreasing quantities.

During the year 1930, the railroads of the United States used as fuel approximately one hundred million tons of bituminous coal. It is evident that no two great industries are more thoroughly inter-dependent. The present-day managements of our railroads and our substantial bituminous coal properties are worthy of each other's confidence and intensive co-operation.

Viscosity of Oil For Car-Journal Bearings

*By C. M. Larson**

DURING the winter of 1929-1930 passenger cars with journal boxes packed with summer car oil left Los Angeles, Cal., where a temperature of plus 92 deg. F. prevailed, for Chicago and on arrival there stood out over night in the coach yard in a temperature of 18 deg. below zero. The next morning when ready to start westward, while backing into the station, all the packing rolled and pushed the lids open. Even reworking and "cut-back oil" failed to stop waste grabs.

One can imagine the work entailed in repacking the large number of freight cars operated by the railroads on this continent twice every season to avoid the effect of temperature changes on journal operation. At that the problem of lubrication on through runs between northern and southern points in winter still confronts the car superintendent. Either the oil, if an A.R.A. winter oil is used, is too thin for the southern temperatures, or, if an A.R.A. summer oil is used, too adhesive and thick for northern temperatures.

To obtain a clearer understanding of the necessary requirements and characteristics of car oils to handle the lubrication of high-speed journals in both cold and warm weather, several makes of car oil were investigated under actual service conditions. Cold weather

* The author is supervising engineer for the Sinclair Refining Company, New York. This is an abstract of a paper presented at the Fifth Oil-Power Conference of the Petroleum Division, A.S.M.E., held at Penn State, May 22, 1931.

operation and its relationship to waste grabs and waste sticking were tested, first, in a journal box assembly in a cold room and, second, by packing freight cars at points where temperatures ran approximately 50 deg. below zero. It was found that when a car oil reached approximately 200,000 sec. viscosity, it became so adhesive that waste sticking took place, while at approximately 750,000 sec. viscosity waste grabs occurred. These differences in viscosity may seem very great, but, when an oil commences to thicken, the difference between 200,000 and 750,000 sec. Saybolt viscosity is only a matter of some 5 to 15 deg. F.

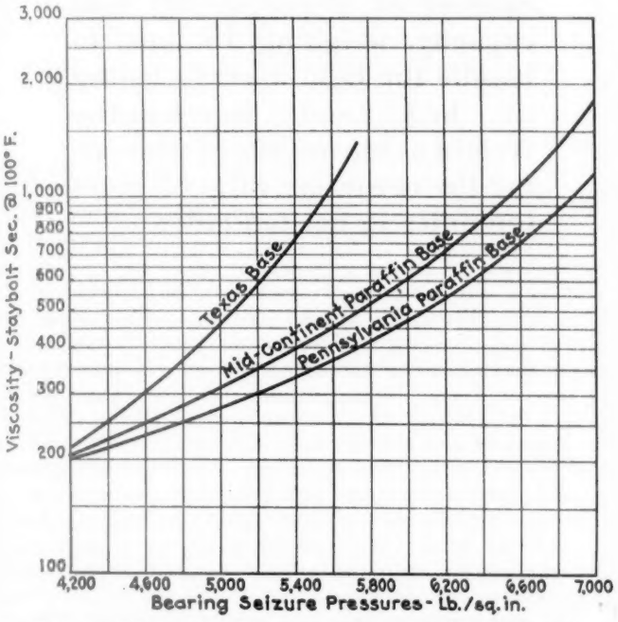


Fig. 1—Film-strength test of petroleum lubricating oil

It is interesting to note that although the wax in the oil gives a false viscosity below the pour, the points at which sticking and waste grabbing occur were those of the oil with the wax removed. When lead oleate or aluminum stearate were added to an oil a false viscosity throughout the entire range was noted, but the cold-weather evaluation was found to be in relation to the temperature-viscosity curve of the separated oil.

This method of evaluating viscosity against cold-weather operation has been very satisfactory in the automotive field for both passenger-car engine starting and gear shifting in cold weather. In all cases the sticky, adhesive nature of an oil at low temperatures is related to the true viscosity.

In warm weather the maintaining of an oil film under heavy loads is of utmost importance. A machine was developed to test lubricating film strengths. Fig. 1 shows the results of some of these tests and that when summer car-oil viscosities (300 to 800 sec. at 100 deg. F.) are used, the selection of the source of the crude oil is essential in order to insure a high factor of safety as regards lubricating film rupture. However, this margin of safety decreases as winter car oils are resorted to.

It will be noted in Fig. 2 that at 200,000 sec. Saybolt viscosity a horizontal line is drawn, above which is indicated the zone of waste grabs based on actual test data of car oils Nos. 1 to 4, inclusive. At 50 sec. Saybolt viscosity a similar line is drawn, below which is the zone marked "Too thin for safety."

Steam-turbine bearings perform most satisfactorily with an oil having a viscosity of 60 sec. at the operating temperature. Turbine bearings are considered a most excellent lubrication arrangement; the journals practically floating on an oil film which is as free from contamination as is possible with a filtering system. Tests on the spindles of cotton textile mills show that when the viscosity of the lubricating oil at operating temperature reaches less than 50 sec., iron oxide is present. Yet, when the viscosity is higher than 70 sec. power is lost due to drag. So, as the limit of high temperature operation, the 50 sec. viscosity is shown in Fig. 2 as the minimum viscosity to insure the proper thickness of oil film.

Plotted in Fig. 2 are the temperature-viscosity curves of the A.R.A. summer car oil and the A.R.A. winter car oil, as well as the viscosity limits. By taking the viscosity minimum at 210 deg. F. and the maximum at 130 deg. F. and extending a line through these temperature limits it will be noted that under the A.R.A. winter viscosity specifications it is possible to make a poorer, more viscous and adhesive product than is possible under the A.R.A. summer car-oil viscousity specifications. In other words, if the 200,000 sec. viscosity maximum is taken for the low temperature limit, the A.R.A. summer oil would show waste grabs at plus 27 deg. F. as against a plus 36 deg. F. for the A.R.A. winter car oil.

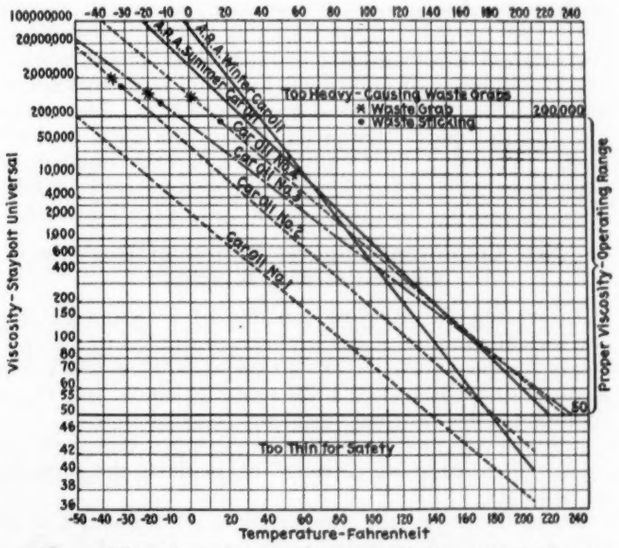
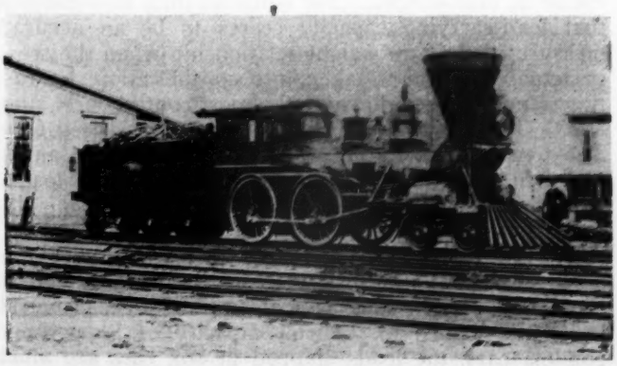


Fig. 2—Viscosity of car oils as applied to railroad-car journal bearings

* * *



From collection of W. A. Lucas

Erie 4-4-0 type No. 144 built in 1853 by Danforth Cooke & Co.

Box-Car Weights Need Reduction

By Wendel J. Meyer

The author suggests the development of a car of 20 tons capacity, weighing 15 tons, to handle the light average lading of l.c.l. and merchandise freight as one means of decreasing the mounting ratio of gross ton-miles to net ton-miles

IN an address delivered at the A.R.A. convention of 1923, a prominent official of the car-building industry, traced the development of railroad cars from the earliest horse-drawn vehicles up to that time. Interesting figures were cited to show that during the industrial expansion from 1902 to 1921, the ton-miles handled by our railroads increased 97 per cent, while the number of cars was increased only 54 per cent. This result was accomplished by increasing the load-carrying capacity of freight cars, which changed from an average capacity of 28.1 tons in 1902 to 42.5 tons in 1921, or 51 per cent, while the aggregate capacity of all cars increased 133 per cent. Attention was forcefully directed to the probability that it would have been necessary to add 2,051,550 freight cars during this 19-year period had the original carrying-capacity been maintained, requiring 77,250 miles of additional yard and side trackage to accommodate the increased number of cars. Moreover, had the railroads attempted to meet the 1902 to 1921 traffic expansion by simply increasing the number of equipment units, a tremendous expansion of all complementary railroad facilities, would have been required.

New Conditions Suggest Review of Box-Car Capacities and Weights

Increasing the carrying-capacity of freight cars was the logical solution of the problem presented to the railroads by the industrial expansion of 1902 to 1921, but a study of trends since 1920 seems to show that many factors of the railroad problems have changed. New conditions are now presented requiring a thorough review of load-carrying capacity, particularly the capacity of box cars.

Some factors of the new problem are indicated in an editorial entitled "Freight Cars Grow Heavier," which appeared in the March, 1931, issue of the *Railway Mechanical Engineer*. This editorial points out that little attention has been paid to the import of the steady increase in the tare weight of freight cars; the average weight per car actually moved in trains on Class I railroads, increased from 20.1 tons in 1920 to 22.2 tons in 1930. The apparent indifference to this important trend is attributed to the fact that load-carrying capacity has been increased almost in exact proportion to the increase in tare weight. The editorial then demonstrates that load-carrying capacity ceases to be an accurate measure of the tare weight relationship when the trend in actual car load is taken into consideration, because this trend has been downward almost continuously since 1920. The average load per loaded car decreased from 29.3 tons in 1920 to 26.6 tons in 1930, showing an increase in the ratio of average tare weight to total loaded weight from 40.7 per cent to 45.5 per cent during this period.

The steady decrease in average car load becomes even more significant when the box car is considered apart. Since bulk freight such as coal, ore and steel products, usually is loaded to the full capacity of hopper and gondola cars, the loads shipped in box cars are much less than the 26.6-ton average load for all cars. In fact it is not unusual to send a box car to its destination with an l.c.l. load of only three or four tons and a load of merchandise rarely exceeds ten tons. Therefore, the inefficiency of using a 50-ton capacity car to haul three to ten tons of lading becomes apparent, the tare weight of the car having been determined by the rated 50-ton load. The efficacy of providing modern 20-ton capacity cars for l.c.l. and merchandise shipments is distinctly a traffic problem, but the car-builder is within his province when he attempts to point out the advantages of modern low-capacity box cars; neither should he be considered impertinent when he suggests that the use of such cars would assist the railroads in their competition with highway trucks.

The importance of low tare weight of freight cars is aptly expressed in the aforementioned editorial by the statement: "These ratios (average tare weight to average total weight), which represent the average effect of increasing weight and decreasing average car load on the operations of Class I railroads of the United States as a whole, suggest that more attention needs to be given to weight in designing freight cars, particularly box cars, if the gross ton-mile burden of producing revenue ton-miles is not to continue its upward course." Difficulties in solving this problem are presented by the demand for increased strength and stiffness along with the demand for large cubic capacity for handling automobiles and some classes of bulky freight. However, the 20-ton car greatly simplifies many factors of the problem. Properly designed, such cars will show a marked reduction in tare weight without sacrificing cubical capacity.

Where Weight Can Be Decreased

When the tare weights of modern 40- and 50-ton box cars are analyzed, the weights of the trucks and underframes are found to be the dominant items. Therefore, the greatest reduction in weight will be accomplished by consideration of these heavy units. By reducing the load-carrying capacity of the car to 20 tons it is possible immediately to reduce truck weight, scaling down of wheels, axles, side frames and bolsters, resulting in a large decrease in the weights of these parts. Some appreciable reduction in weight follows the lighter loads on body bolsters and cross bearers and the weight of the side construction can be reduced slightly, but radical change of center-sill area would be resisted by car department officers because the low capacity cars would be associated with heavy cars in long trains and in switch-

(Concluded on page 104)

What About The Railroads?

ELIHU Root gave a series of lectures at Yale University in 1907 on "The Citizen's Part in Government."* Among other things he pointed out that our democratic form of government in this country is still on trial, since its ultimate success will depend on the extent to which each individual citizen discharges his full civic responsibilities. Unfortunately the average citizen today is not giving much intelligent concern to these matters, but is leaving them largely in the hands of politicians and lobbyists.

That we cannot much longer allow this condition to exist without grave danger of catastrophe is emphasized in the following statement from one of Mr. Root's lectures: "The proportional part played by government in the personal affairs of every individual life is rapidly increasing. The crowding and complications, the inventions and improvements and co-operation of modern life have enormously increased the dependence of men upon each other."

The railroads have been a large factor in bringing about this complicated modern existence—and today, although they handle 75 per cent of the traffic transported in this country, they stand in grave danger because as public utilities they are at the mercy of governmental control and regulation, which has failed abjectly in measuring up to a reasonably high standard of performance. It has been strong on details and weak in a large way in a constructive statesmanlike handling.

It is therefore of vital importance that the people generally take a larger and more intelligent interest in this and similar problems, else they may wake up some day and find that irreparable damage has been done to our common welfare, if indeed it has not already been done.

Railroad employees of all classes and in all departments should be well informed about governmental relations to the railways and should do their full part as citizens in helping to direct railroad legislation and regulation along safe and constructive lines.

Railroads Unwisely Regulated

A man in the securities business could not understand why he could not sell railroad stocks or bonds to his customers and attempted to analyze the problem. As a result a book, "The I.C.C. Versus Class I Railroads of the United States," written by Horatio L. Whitridge, was recently published in inexpensive form by the Simmons-Boardman Publishing Company.

Mr. Whitridge has assembled a large amount of data covering the experiences of the railroads since the Transportation Act of 1920 became effective. No one in these days questions the advisability of a reasonable amount of regulation for our public utilities. The public interest is, of course, the paramount consideration and must be fully protected. Regulators apparently, however, have been so busy in *shortsightedly attempting* to protect the interests of the public that they have almost killed the railroads, whereas the public interest would have been best served by using good statesmanship in intelligently fostering them.

As Mr. Whitridge states, "The Interstate Commerce Commission has in years gone by repeatedly attempted to have Congress delegate to it the authority to operate the railroads, to the end that commerce should move freely, and as nearly free as possible, in which policy the Commission has shown greater interest than in treating the railroads as private property, devoted to the public use, but still entitled to all the protection given to private property under the Constitution of the United States."

The commissioners are worked almost to the limit of endurance, handling a great multiplicity of details and heading up a variety of bureaus, at an expense to the citizens of this country of about nine million dollars a year. Incidentally, can anyone explain the "holier than thou" attitude of these government servants—high and low—in attempting to direct the great army of experienced railroad officers and employees? It would indeed be ridiculous if its effects did not promise to prove so serious.

What Can We Expect?

What is to be expected, however, of a Commission "composed of eight lawyers, one newspaper reporter, one railroad engineer and one economist," one of which, and a most active one, avowedly favors government ownership of the railroads? Mr. Whitridge's book, which bears the sub-title, "The Nullification of the Transportation Act," shows in detail how and where the Interstate Commerce Commission has failed to measure up to its full responsibilities.

Incidentally, Mr. Whitridge includes in the book the final report on the co-ordination and development of transport, of the Royal Commission on Transport of Great Britain, the conclusion of which, as to the railways, reads as follows: "While we have thought it our duty to criticize railway management to some extent and to make certain suggestions for its improvement, we do not fail to recognize the great services railways have rendered and are rendering to the country. We are profoundly conscious of the importance of maintaining an efficient and prosperous railway system. Railways are far from having been rendered obsolete by newer forms of transport, as stage coaches, and, to a considerable extent, canals were when railways were introduced. For many purposes—in fact, for the main business of transport—they are indispensable, even though newer forms of transport have, in some ways, modified the position they previously held. In addition to this, an immense proportion of capital is invested in the railways, and so long as they remain indispensable, the nation cannot afford to place this capital on the scrap heap or even to render it partially unremunerative. The aim should be to harmonize and coordinate the newer and the older forms of transport with the object of obtaining from each the maximum of advantage."

What the Individual Can Do

How can a railroad employee be most helpful in discharging his civic duties?

First, he should inform himself, as fully as possible, about the facts concerning railroad operation and regulation, so that he can answer intelligently questions of his friends and neighbors, and reply to unjust criticism from whatever source.

* Published in book form by the Yale University Press, 1907 and 1920.

Second, he should painstakingly discharge all of his functions as a citizen. This means not alone voting at the polls and paying taxes, but rather in going to the very roots of the matter and seeing that the right men are selected and put forward as candidates for office. It is a serious delinquency to allow this selection of the candidates to rest in the hands of politicians and "interested" parties. Exactly what steps are taken to place a man's name on the ballot? A study of this question could well be made by all citizens.

Third, keep after your representatives in the town council, the state legislature and Congress. You say you are only an individual and that they will not pay any attention to you. You are mistaken. Remember this, these people keep their "ears close to the ground." They want to know what is in the minds of their constituents. They do pay attention to those who are interested enough to make their opinion known. Silence, in their opinion, is equivalent to approval, or at least is evidence of disinterestedness.

Mr. Whitridge's book gives the facts about railroad regulation and its shortcomings. It is easy to read.

Box-Car Weights Need Reduction

(Continued from page 102)

ing movements. Taking all these factors into consideration, a conservative estimate of a carefully designed 20-ton car places its tare weight at about 30,000 lb. Comparison of this figure with 46,500 lb., the weight of a modern A.R.A. standard 50-ton box car, shows a reduction of 16,500 lb. Based on 70,000 lb. and 169,000 lb. maximum weight on rails for the 20-ton and 50-ton cars respectively, the ratio of tare weight to total limit weight is 43 per cent for the 20-ton car and only 27.5 per cent for the 50-ton car, but, with a 10-ton load of merchandise, the ratios are 60 per cent for the 20-ton car and 70 per cent for the 50-ton car.

While such ratios furnish interesting statistical comparisons, actual tare weight is the important consideration. It has been estimated that a freight car spends only about 43 days of each year actually on the road and eleven of these days are spent running empty in search of load. Since the average car is empty during about 25 per cent of its total time behind a locomotive, its actual tare weight has a tremendous influence on locomotive fuel consumption. Fuel consumption is still a major item of railroad operating expense in spite of the excellent advance which has been made in locomotive efficiency during the past eleven years.

Suggestions for Using the Light Cars

On account of its low tare weight, the 20-ton box car presents the feasibility of inaugurating scheduled package-car service for short-haul traffic. To be efficient, such service should be arranged to keep these low-capacity package cars out of classification yards and switching movements, by making up trains so that a car may easily be dropped at its destination and another, consigned to a point farther along the line, may be picked up. Moreover, supplementing this short-haul package-car service with a trucking service operated by railroad companies in strategic towns and cities would result in an important step toward regaining the traffic which the highway trucks have succeeded in taking from the railroads. The economical radius of operation is purely a traffic and operating problem, but whether the radius be fixed at 30, 50 or 90 miles, the important factors of the problem are unchanged. Even though the highway truck may have the advantage in the thirty-mile haul, the railroad could afford to operate at a loss in this territory in order to promote and advertise the new service, depending on the profitable longer hauls to make up the deficit. The most important aspect of the problem is the requirement that the railroads must devise a service which will give the shippers better, cheaper, quicker and more convenient transportation than is now afforded by the highway truck. Tare weight of box cars enters the problem because it is more economical to haul a light load than a heavy one.

The classification yard and other switching movements enter the problem of car design because the shocks encountered in these fields subject the cars to their greatest punishment and consequent damage. To enable the cars to withstand the handling received in modern switching movements, the car designer has been compelled to add weight. Minimizing all classification movements of the proposed 20-ton cars will permit additional reduction in the weights of center-sills and underframes and further decreases in tare weights.

The automotive industry has benefited the railroads by immense shipments of raw material, supplies and finished products and by creating large shipments of road-building materials. The fact that a product of this industry, the highway truck, now has entered the transportation field as a competitor must be faced courageously by the railroads. The problem will not be completely solved by appealing to outside help for increased rates, decreased taxes nor by penalties imposed upon the competitor; the solution must come from resourceful railroad management. Load-carrying capacities of box cars and tare weights are important factors of the problem, which demand a thorough review.

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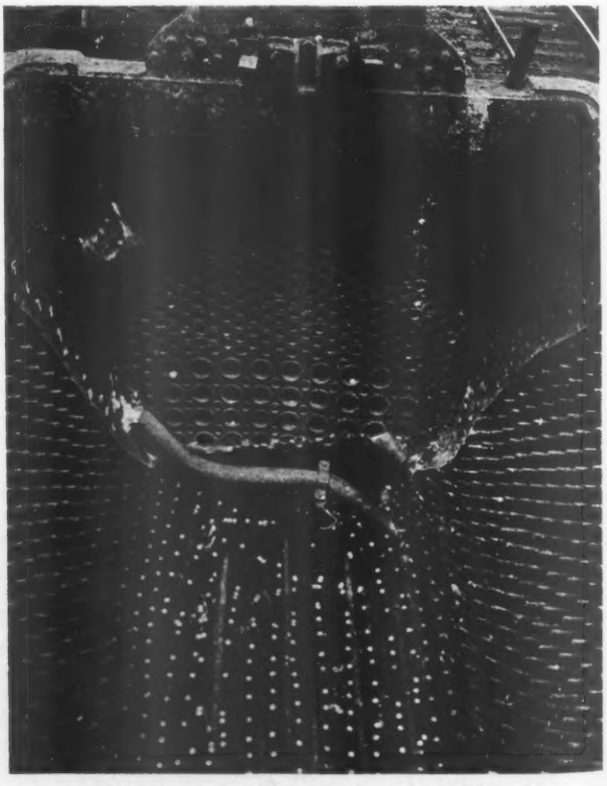


Crown-sheet failure due to low water which caused four deaths and serious injuries to two persons—Water-glass opening plugged by rubber gasket

EDITORIALS

Plain Nuisances

Black smoke spells waste in no uncertain terms. Noise and din cause confusion and distraught nerves and spell inefficiency. The railroads make plenty—yes, too much—of both of these nuisances.

Smoke

The railroads are fighting for their very existence. Private automobiles and competition of the motor bus have steadily been cutting more and more into their passenger traffic for many years. The rate of growth of freight traffic in normal times has also been slowing up. In order successfully to cope with such competition, every possible step must be taken to increase the efficiency of operation. The service must also be improved and public opinion must be rallied to the support of the railroads.

The quantity of smoke emitted from the stack is a measure of the efficiency of fuel consumption—in the inverse ratio. This in itself offers a sufficient incentive to go to unusual lengths in smoke abatement programs on the railroads, but there is another factor which is equally, if not more important, and that is, the reactions of the public to smoke from locomotives, terminals and repair plants.

The American public is becoming more and more sensitive to the smoke nuisance and is less and less inclined to tolerate it. The railroads must have the good will of the public and are simply inviting trouble if they do not aggressively carry forward programs to eliminate the smoke nuisance—and it can be done; at least certain roads, or certain parts of some roads, have made remarkable records in this respect. It is largely a matter of education; education not alone for the men on the engine, but of the entire organization, since many factors are involved, such, for instance, as the quality of the fuel, the provision of a uniform quality in a given district, the condition of the power, the control of various elements of train operation, etc. Close and intelligent supervision is also necessary. High standards of performance must be established and no deviation from these standards can be tolerated, else the entire organization quickly slips back into a state of indifference.

The mechanical engineer has not as yet discharged his full responsibility. After all, the successful working of any device operated by human beings must be made as foolproof as possible. Are there not ways in which the designs of locomotives and boilers can be so improved that more and more the efficiency of combustion can be automatically controlled, thus making it possible better to control the smoke nuisance?

Noise

One of the irritating things that have come to us with modern industry and the extended use of mechanical power has been the noise and din. It began with the introduction of the steam engine and has always characterized railroad operation. The total effect of all this noise and racket upon human beings is exceedingly serious. This is more and more becoming recognized and various agencies have been set up in the last few years to study the problem and also to take scientific measures to reduce or, if possible, eliminate this nuisance.

Obviously little attention was given to such things in the earlier stages of industry. Quite automatically much noise in the operation of machinery has been eliminated because, as we have developed larger and more efficient machines, the tendency has been to make them more and more smooth running and noiseless. With such improvements being made in the field of industry and construction, the public naturally looks to the railroads to improve the design and operation of their equipment, so that trains can be operated with less disturbance to the communities through which they pass and to the passengers riding in them. Unfortunately, little progress has been made, except possibly on those railroads which have electrified their suburban services.

Here again, the problem of improving conditions involves improved designs of machinery and equipment, aggressive and painstaking educational processes, and eternal vigilance on the part of the supervision. Undoubtedly, also, the mechanical engineer can make a large contribution by applying to the design of railroad equipment some of the principles and materials which have been developed in recent years and which are doing so much to minimize noise and din in other fields of industry.

What might it not mean in meeting and overcoming competition for the passenger business, for instance, if the passengers could make their journeys in greater comfort, cleanliness and quiet? Surely such objectives are not impossible of achievement. On the other hand, the continuance of the present smoke and noise nuisances on the railroads promises to meet with determined resistance on the part of the public, if greater efforts are not made to do away with them.

Locomotive Attention At Terminals

Since steam locomotives spend, on the average, more than half of their time at locomotive terminals, the idea has been advanced that the terminal should be considered comparable to an operating division, at least in so far as scheduling locomotive movements through the terminal is concerned. This does not mean that a separate organization or division of authority should be created for operating the terminal, but simply that more attention should be given to proportioning locomotive time at terminals with a view to maximum economy and locomotive availability.

All of the operations and movements of a locomotive from the time dispatched until it arrives at a terminal are carefully watched and recorded, except possibly measuring the exact amounts of fuel burned and water used, which is done only on special test runs. From the time a locomotive arrives at the terminal until it is dispatched, however, relatively little information is available as to its handling. A certain amount of repair work usually has to be done, being checked off as completed and the locomotive marked up on the dispatcher's board when available for service. Would not

a more general periodic analysis and checking of individual locomotive-conditioning operations at all terminals be worth while in assuring a uniformly satisfactory performance?

About the only measure of overall efficiency at the locomotive terminal is "cost per locomotive turned," which is a more or less indefinite basis of comparison between two terminals, or even for one period as against another at the same terminal. That this item of expense, as well as the proportion of time locomotives spend at terminals, can be substantially reduced by the introduction of modern machine tools, drop-table equipment, etc.; up-to-date outside facilities, such as mechanical ash plants and automatic coal- and sand-handling apparatus, and ample stationary-boiler capacity for steaming locomotives in the enginehouse without lighting fires, is hardly to be doubted. Improvements are also effected by the consolidation of terminals. In some instances, one enginehouse and staff have been provided to replace as many as three or more smaller enginehouses and separate organizations. This concentration of terminal-conditioning work at a single point has permitted the provision of improved facilities and greatly reducing the unit cost of locomotive handling.

Except for a relatively few terminals, most existing locomotive terminals are operating on essentially the same basis as they have been for many years, at least as far as their mechanical facilities are concerned. Additional terminal improvements on practically all roads may be accomplished by a more systematic check of operations to assure the best results with the facilities at hand and by the improvement of these facilities as fast as practicable. The objectives sought in modern terminal operation may well be summarized in terms of improved locomotive utilization as represented by a reduction in the time required to return locomotives to service; improved maintenance condition of locomotives, resulting in a reduction of failures and larger output of locomotives while on the road, and a reduction in cost to perform all necessary routine and maintenance operations at the terminal.

Freight Cars in High-Speed Service

In the urge to meet competition, both between themselves and other transportation agencies, steam railroads have speeded up freight service substantially. In fact, the average speed of freight trains for the first 10 months of 1931 was 14.7 m.p.h., an increase of practically 25 per cent over that of 10 years ago. To achieve this average, many trains run at much higher speeds and, in fact, sometimes approach passenger-train schedules. For example, since October 1, 1931, the St. Louis Southwestern has been operating the "Blue Streak," known as America's fastest freight train, between East St. Louis, Ill., and Texarkana, Ark., a distance of practically 560 miles, in 16 hr. 35 min. elapsed time. The schedule of this train calls for four stops, aggregating 38 minutes, which reduces the running time to practically 16 hours, and makes the average running speed about 35 m.p.h.

The requirements in the way of freight-car conditions to permit safe operation at speeds such as this can be readily appreciated. The special attention given to cars reserved for service in the "Blue Streak" is described by J. R. Turney, vice-president of the St. Louis Southwestern, as follows: "The very best cars available for merchandise loading are selected in the East St. Louis yard for preparation for the following day's loading at Florida street. Special inspection is made of all journals, brasses and wedges. Oil boxes are repacked with new oil and new waste. On an average, each car so prepared requires three journal wedges and five brasses. Oil boxes are also carefully inspected for loose and wornout box bolts. Seven box bolts are renewed on an average per car. Grip nuts are applied to all box bolts when missing. Unusual, careful inspection is made of all brake beams and an average of three brake beams per car are applied. Cars are equipped with one-inch solid-eye brake hanger and 1¼-in. brake-hanger key bolts; flat split keys ¾ in. by 3½ in. are used in the key bolts.

"Cars are jacked up on both ends for inspection of center plates and center pins, and side bearings and center plates at both ends are oiled. Air brakes are cleaned at intervals of nine months, instead of the usual cleaning once a year. Extraordinary inspection is made of couplers and draft gear and care taken to see that brake-beam safety irons are in good order before departure. Side doors are carefully inspected, and, when necessary, repaired to make sure they are in good working order and delay will not be incurred in getting them open at intermediate points. When packing oil boxes, special care is taken not to place packing so high as to create hazard of waste grab when cars are operated at high speeds over frogs and switches and railroad crossings. Wheels are closely inspected and any that are not in first-class condition are removed."

After this extraordinary servicing, as described by Mr. Turney, tags stamped "Special" are applied to the cars, indicating that the cars are not to be used in any service except the "Blue Streak." Owing to the unusual care in checking journal-box, wheel and truck conditions, it is reported that the St. Louis Southwestern has had but one hot box on this train since it was placed in operation five months ago.

A New Era In Transportation

For some time there has been a growing opinion that any future improvement in net railway operating income must depend almost entirely on reductions in the cost of operation. For many years prior to the end of the World War there was an accelerating increase in the volume of freight traffic. While improvements in operating efficiency received constant attention during this period, they were aimed at increasing the capacity of the railroads to meet the growing demands fully as much, if not more than, at decreases in unit operating costs for their own sake. Increasing gross revenues were favorable to increasing net. Since the close of the war, however, the freight-traffic demands on the railroad have become stabilized. The upward trend in volume since that time has been insignificant in amount.

But a new condition of even greater significance than the apparent stabilization of freight-traffic demand is now forcing itself on the attention of railway officers; that is, the growth of competition from other transportation agencies which is assuming disturbing proportions. Prior to the awakening effected by the present depression, few persons interested in railway transportation gave a moment's consideration to the possibility that railway methods needed major changes to meet changes in business conditions and the desires of shippers as to how or when their freight was to be accepted,

forwarded and delivered. It was accepted as an axiom that the transportation requirements of the country must adjust themselves to the convenience of systematized station, yard and train operation. Now the railways, utilizing their time-honored methods and equipment, find themselves unable to compete successfully with highway transport in a growing volume of l.c.l. and merchandise carload shipments. While some of the advantage in favor of highway transport lies in the absence of regulation and in subsidies from the taxpayer, these are by no means its only advantages. Quicker deliveries, cheaper packing and more convenient schedules, to suit the desires of individual shippers, are highly important factors in its favor.

What is the position in which the railways now find themselves? Inland waterways, pipe lines and the Panama Canal are making significant inroads in the field of mass transportation, for which the railways are pre-eminently adapted. In its study of inland waterways, the Bureau of Railway Economics estimated that in 1928, pipe lines handled 30 billion ton-miles and inland waterways 13 billion ton-miles. The Department of Commerce reports that the intercoastal movement through the Panama Canal during that year amounted to 9¾ million tons, which, had it been moved by rail, would probably have accounted for approximately 20 billion ton-miles. Here is a total of about 63 billion ton-miles, or over 13 per cent as much transportation service as the 477 billion ton-miles handled by the railroads. In the short-haul movement of package freight and carload merchandise, motor trucks were estimated to have handled 10¼ billion ton-miles in 1928, an estimate which has since been conceded to be much too low. Whatever the amount may have been, its importance lies in the fact that it represents business which moves on high rates. Furthermore, since that time motor-truck service has made further inroads into the high-tariff business of the railroads, one estimate indicating that it amounted to 10 per cent of the ton-mile volume of railroad traffic in 1930.

From time to time as attention has been called to the gradual loss of l.c.l. traffic it has been suggested that the railroads might be better off without this business, because the cost of terminal handling and transfers make it unprofitable. The same conditions which are causing the loss of this business, however, are endangering the profitable merchandise carload business and, unless active measures are taken to permit the railroads to compete for this business on a profitable basis, they will find it increasingly difficult to maintain their position as a low-cost mass transportation machine in the face of growing competition from inland waterways.

This means that the problem of future development must be faced in a new attitude. Railroads must be adapted to meet not only the economic needs, but the wishes, of shippers even though this entails major changes both in equipment and operating methods.

For many years there has been a steady increase in the average weight and capacity of freight cars. This development has resulted from a centering of attention in designing on the use of cars for various kinds of bulk shipments. In the case of open-top cars this has produced a satisfactory result, since these cars may largely be classed as single-purpose units for the handling of products of mines. In the case of box cars, however, the class of service which controls their design represents a small percentage of their actual utilization.

Elsewhere in this issue Wendel J. Meyer proposes the development of a box car of 20 tons capacity weighing 15 tons, to be used for light l.c.l. and merchandise lading. The purpose which the author has in mind in making this proposal is to decrease the mounting ratio of net ton-miles to gross ton-miles; that is, to effect economy in operation.

Operating economies will be of as great, or even greater, importance in the future than they have been in the past. But the salvation of the railways will not be effected by considerations confined to decreasing the cost of present methods of operation. As R. H. Aishton, president of the American Railway Association, pointed out in his talk at the 1931 meeting of the Mechanical Division, the future of the railway industry depends in a large measure on a willingness of railway officers to forget precedent and aggressively undertake to make the service whatever rapidly changing commerce and industry want it to be.

It is becoming more and more evident that this will require new types of equipment. At the present time, for instance, there is an increasing demand for cars suitable for the bulk shipment and gravity unloading of cement. A new industry for the preparation and distribution of frozen foods will soon demand mobile refrigeration at temperatures considerably below those now customarily obtained in refrigerator cars of conventional construction. The demand for a reduced cost of packing of many products for shipment requires improvements in the character of freight cars, both as to protection against destructive stocks, and in character of the container itself. The cost of transportation includes collection and delivery, as well as rail shipment. Simplification and cheapening of the process of transferring freight between road and rail is a necessity which the railroads must meet.

These are not problems which mechanical department officers can solve alone. They are problems which require close co-operation among mechanical, traffic and operating officers. Mechanical officers can, however, contribute largely to hastening their solution by a willingness to accept and adapt changes in established standards and practice whenever it becomes apparent that their retention hinders the development of new traffic or the retention of the old. Bureaucratic inertia must give way to initiative and aggressive determination if American railways are to remain what they have been in the past—the best and cheapest inland transportation machine in the world.

NEW BOOKS

WAGON DETAILS AND CONSTRUCTION. *By P. H. Saunders, A.M.I. Loco. E., M.I.E.I. Published by Crosby Lockwood & Son, Stationer's Hall Court, Ludgate Hill, E.C., London. 142 pages, illustrated. Price, 7 shillings, 6 pence.*

In this handbook the author has endeavored to explain the main points of car building in general, selecting the most difficult examples met with in the methods of construction of British, continental and colonial railway cars. Detailed explanations of the methods of making the ironwork which enters into car construction are given, and also some description of the various machines and appliances used in car building. The book is intended for railway engineers, students, and those engaged in the design and construction of railway cars, or for those concerned in the change-over from wood to steel car building.

THE READER'S PAGE

A Question on A. R. A. Rule 3

To the Editor:

It appears impracticable to make proper repairs to certain cars which come to our attention.

A.R.A. Rule 3, Section c, paragraph 2, requires all cars built after November 1, 1920, to have A.R.A. Type D 6-in. by 8-in., or Type E 6¼-in. by 8-in. shank couplers. Since that time there have been quite a number of cars built with the Type D 5-in. by 7-in. shank, 8½ in. butt couplers and stenciled "Type D couplers, 5-in. by 7-in. shank, 8½-in. butt."

What I should like to know is how to make proper repairs to these cars when they are under load, it not being practicable to transfer the load or hold the car to get material from the car owner.

Could we apply an A.R.A. Type D coupler, 5-in. by 7-in., shank, 9⅛-in. butt, and an A.R.A. yoke and charge the owner for betterment, or would we have to apply an A.R.A. 6-in. by 8-in. shank coupler and get paid for our time and material? W. E. Hogbin.

Answers to Air-Brake Questions—The Release Pipe

To the Editor:

In the December, 1931, issue of the *Railway Mechanical Engineer* I note that Mr. Herndon has answered several of the air-brake questions. If the question involved refers to the No. 6 E. T. brake and by the U-pipe is meant that part of the release pipe between both brake valves, Mr. Herndon has answered the questions correctly.

The retaining-valve pipe under a car is connected to the exhaust port of the triple valve. The release pipe on the locomotive is connected to the exhaust port of the distributing valve. The bottom portion of the distributing valve is nothing more than a triple valve. On a car, the retaining-valve pipe runs up to the retaining valve and, when the retainer handle is turned down, the pipe is open to the atmosphere. On a locomotive, the release pipe runs up to the automatic brake valve, but it passes through the independent brake valve first before reaching the automatic. In other words, when the independent brake-valve handle is in running position, the release pipe runs through it to the automatic valve.

If the release pipe, after leaving the distributing valve, ran up to the automatic valve first, we can readily see that to get an independent application we would have to move two brake-valve handles. But by having the release pipe pass through the independent valve, the release pipe leading to the automatic is blocked as soon as we move the independent valve out of running position. We get an independent application and only have to move one brake-valve handle.

When an engineman applies the automatic brake, he blocks his release pipe at both ends. If double heading, the engineman on the head locomotive, in addition to blocking his release pipe at both ends, also blocks the release pipe at the distributing valve on the second locomotive, otherwise the brake on the second locomotive would not apply. If the independent brake valve only is moved out of running position, the release pipe is blocked in the middle.

The release pipe is the most important pipe on the E. T. equipment. Still it is nothing more than a retaining pipe, but the reason why we do not call it a retaining pipe is because it is on the locomotive instead of on a car. W. C. Garaght.

Renewing Arch Bars—An Answer

To the Editor:

Replying to "A. Subscriber's" question on The Reader's Page of the February issue of the *Railway Mechanical Engineer,* the third paragraph of Rule 26 reads as follows: "Arch bars and tie bars, as to the above standard dimensions, shall be maintained in kind." Therefore, relative to the question of applying a 1¾-in. by 4½-in. arch bar on a truck having a ½-in. by 5-in. bar standard to the car. I would take the rule to mean that either bar substituted for the other would constitute wrong repairs.

A. Reader.

[This letter was not signed by the writer. However, because it is an answer to a question which was asked by one of our readers, we have published it even though we do not know the identity of the writer. A number of other letters with anonymous signatures have been received from time to time for publication in this department. Opinions set forth and published in letters in this department are, of course, not necessarily those of the editor of the *Railway Mechanical Engineer.* Any letter deemed to be of sufficient intrinsic interest to our readers will be printed. If a writer so desires, his letter may be published anonymously, but every communication must be accompanied by the writer's name and address to insure good faith.—Editor.]

Wow! A Hot One For the Editor

To the Editor:

It seems to me your editorial, "Hidden Treasures," in the *Railway Mechanical Engineer* of February, page 65, is just a lot of "hooey." The illustration you give is striking, but after all, is it representative? Are you not drawing unwarranted general conclusions from a rather unique specific case? To me the editorial sounds a good bit like preaching—high sounding words and sentiments without a sound logical common-sense basis.

The human element! What is it in a railroad shop or elsewhere in the mechanical department? You dignify it with a lot of importance. Yet, after all, is it not something which is very intangible—and thus well suited for bluffing and alibi purposes? The average chap on a railroad is not so very different from a machine. He is not wildly interested in his work, except that it brings him a wage for the support of himself and his dependents. He is very much of a machine in some respects; he doesn't want to be bothered with problems which require initiative or aggressiveness. He

is happy and contented when undisturbed and running along in a rut.

Of course, among the entire bunch there are a few—extremely few—ambitious self-starters, but why worry about them. They will forge to the top anyway. You can't keep them down.

Why waste good paper and printers' ink in these hard times by letting your imagination run riot, unless, indeed, your objective is to distract our attention with a bit of subtle, ironic humor.

Forget it! WADDY.

Hidden Treasures—A Labor Audit

MIDDLETOWN, OHIO.

TO THE EDITOR:

I happened on your very interesting editorial entitled "Hidden Treasures" in the February issue.

It should strike a responsive chord, because almost every company of any considerable size has a number of capable men buried somewhere within the mazes of its organization. A few years ago The American Rolling Mill Company recognized this fact, and endeavored to do something about it. The result was a labor audit which, though it is faulty and certainly not one hundred per cent efficient, is at least a step in the right direction. Later on, when the steel business becomes more profitable, our personnel department tells me that they intend to follow up on their audit more aggressively and believe they can improve upon it.

After reading the editorial I thought you might like to see what we have done, and am attaching a copy of an article describing our practices.

HUGH W. WRIGHT,
Assistant to Director of Publicity, American Rolling Mill Company.

* * *

[Mr. Wright enclosed with his letter an article entitled, "How Armco Measures the Worth of Its Men,"

PERSONNEL MAN'S GUIDE FOR QUESTIONING FOREMEN IN TAKING PERSONNEL AUDIT

GENERAL RATING

Exceptional—Above Average—Average—Below Average

AS WORKER ON PRESENT JOB

Good Man—Hard Worker—Plugger Type—Slow—Speedy

DEPENDABILITY

Steady—Irregular—Lays Off Without Notice—Late to Work—Requires Supervision—Carries Out Instructions

AMBITION

Tries Hard—Looking Forward to and Learning the Next Job—Taking Armco Training

INITIATIVE

Goes Ahead by Himself—Clock Watcher—Needs a Leader—Can Lead Men—Lazy

DISPOSITION

Cheerful—Noisy—Sulky—Alert—Gets Along Well with the Men—Co-operates

PROMOTION

Can Handle Next Job—Will Make a Leader—Formanship Timber—Reached His Limit—Needs Experience—Needs Training.

TRANSFERS

Would Fit in Better Some Place Else—Has Asked for Other Work—Deserves Something Better—Unsatisfactory.

prepared by C. H. Murray, director to personal, American Rolling Mill Company, which was published in the Iron Age last September. Mr. Murray introduced the system about eleven years ago. The following extracts are taken from his article:

"The personnel audit" is the organization of a system which provides for fact-gathering, compilation, and the proper utilization of the facts. Though no system has ever been devised which will measure efficiently human characteristics, it is surprising the great amount of information about persons employed by any company which can be uncovered and made available by a simple personnel audit. Designed primarily to point out the relative abilities of the individuals and to prevent the channels of progress from becoming clogged, it refreshes the mind of the immediate supervision regarding the capabilities of the men under it, familiarizes the personnel division with the character of the employees, and is a factor in many organization matters.

It is logical that a personnel audit would be of special benefit in peak periods when an organization is rapidly expanding, or in periods of depression when it is contracting. In both situations, that vital and intricate problem of placement, or removal, of men must receive intelligent and serious consideration because it exerts a powerful influence upon making better products at a lower cost. When the business is growing, management should be assured that its organization is of the proper caliber before any important extensions are affected. Just the reverse is true when it is necessary to pare the organization.

The taking of the audit is not at all complicated. The personnel men visit each department once a year and check with every man's immediate superior his qualities, good or bad. To standardize the information sought, a form has been prepared which serves as a guide for questioning. The personnel man, however, is not required to limit his inquiry to the questions suggested by the form.

The audit has proved its value to us many times over, for it gives at a glance a running inventory of the entire Armco organization; it tells us where the individual and the company require additional strength; and it points out the men in our own ranks capable and available to fill these positions. It is in effect an annual statement of organization.]

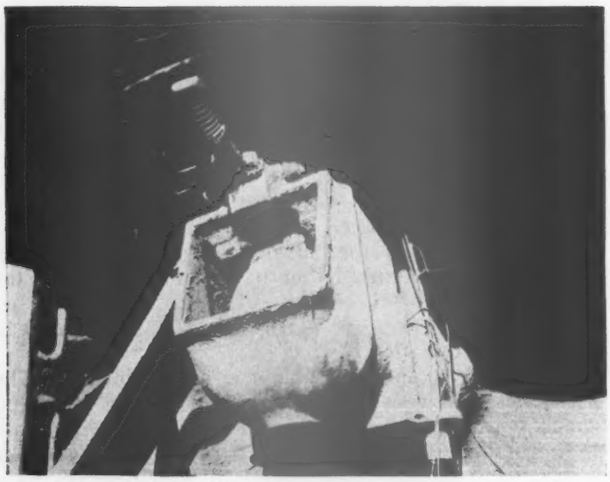
Why Do Steel Wheels Check?

TO THE EDITOR:

Within the past two or three years I have noticed that the thermal checking of rolled or forged steel wheels in passenger service is becoming more and more a serious problem. I might say, at the outset, that the greater part of my personal contact with this problem has been on one or two railroads operating fast schedules in comparatively level territory. Also, that most of the difficulty seems to be in passenger service and practically none in freight service. I am wondering whether the same condition is being experienced by those roads operating cars equipped with steel wheels in fast freight service and whether or not the condition may not be more serious on those roads operating in heavy-grade territory where fast schedules and a great deal of braking are part of every-day operation.

A few years ago our trains were equipped with braking equipment having less braking power and it was the custom for enginemen to approach stations and stops at fairly low speed. However, with the advent of modern braking equipment which permits more rapid deceleration of heavy trains enginemen are now approaching stops at high speed and bring trains to a stop in a relatively short time. Possibly this is the answer to the large number of wheels that we find we must remove from cars in passenger service because of thermal checks. A READER.

With the Car Foremen and Inspectors



Loose journal-box bolts are liable to shear off and cause a costly accident

Wanted—A "Form Period" For Freight Cars

By H. K. Allen

ON many of the railroads today a modern system of car inspection has been adopted—a system whereby an individual car inspector is held responsible for the safe movement of a car to its final destination without its becoming necessary to switch the car to a repair track while it is enroute. This system of inspection is commonly known as "individual responsibility" and took the place of what formerly was called "collective responsibility." In years gone by an inspection force was maintained at each terminal through which a train passed but now, with the advent of long runs and main-tracker movements the inspection force at intermediate terminals has been practically eliminated. This places the responsibility for proper and careful inspection upon the one inspector who now attaches a certification card bearing his signature to the side of the car to indicate that no further inspection is necessary during the particular movement the car is making while enroute to its desination.

This system has been productive of exceptionally good results, first by insuring more careful inspection of cars at originating terminals and second, by the increased daily car mileage, due to elimination of intermediate inspections. On the other hand, how much progress has been made in the actual prevention of train accidents and delays resulting directly from car failures?

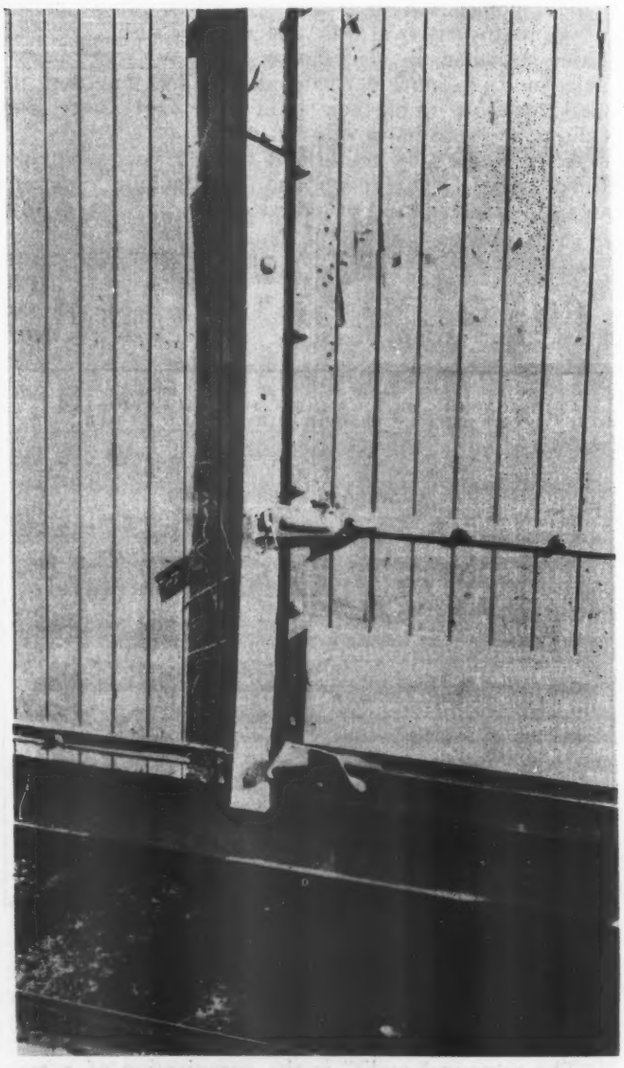
A car inspector can be expected to detect such defects as missing or broken cotter keys, missing bolts and nuts. He can readily see a worn wheel, a broken sill, a low or otherwise defective coupler and the various defects associated with safety appliances. However, there are many defective conditions which exist on freight cars that are more or less difficult to detect and which are liable to be overlooked.

Among the more common of these defects are cracked or broken arch bars, especially when the crack is in the back of the bar or is concealed by the lip on the bottom edge of the column stand. Back sections of coupler yokes, draft gear parts and cracked or worn brake-beam hangers as well as many other parts which are concealed from view are responsible for numerous failures and resultant delays to trains.

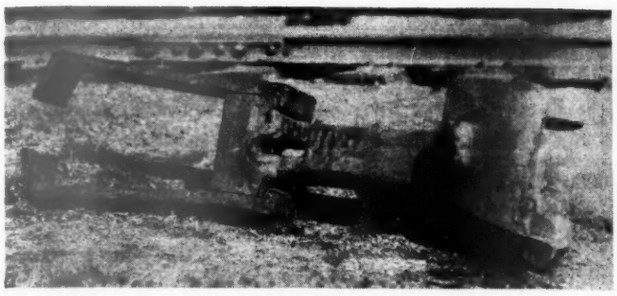
There is but one sure way to discover these defective conditions and that is by placing the cars on repair tracks, or on tracks designated for the purpose of giving periodical inspection to all parts that cannot be observed without removing the concealed part or parts.

Periodical Inspections

A few of the larger railroads have adopted a plan whereby a definite schedule is maintained for the pur-



Temporary repairs made to box-car side doors, including the fixtures, should be corrected as soon as the car arrives on home road



Defective back sections of coupler yokes cannot be detected by train-yard inspection—The coupler must be removed for examination

pose of making a careful examination of draft gears in order to remedy conditions which cause excessive slack and failures. On other railroads this schedule provides for the removal of brake beams for inspection and the renewal of the hangers and pins. However, with the exception of the air-brake cleaning period and the repacking of journal boxes every year, the A.R.A. code of interchange rules makes no provision for the periodical inspection of mechanical parts of freight cars.

The interchange rules provide for the cleaning of the air brakes every 12 months and the repacking of the journal boxes within the same period, yet seldom, if ever, can a freight car be found bearing stencils to indicate that both of these inspections took place on the repair track at the same time. They may be anywhere from two days to nine months apart, indicating that the car was switched out of the train yard and placed on the repair track twice whereas one handling would have been enough.

Frequently it is necessary to renew a brake-beam hanger or a hanger pin in the train yard while the car is under load due to the failure of this particular part. As a matter of fact all of the hangers or pins are subject to this same failure for the reason that they are sufficiently worn to warrant renewal also, but on account of limited time it is not possible to do this work in the train yard. On the other hand, had this car received a periodical inspection by the home road and the parts which are subject to wear been repaired or replaced, the individual failure would not have taken place and there would be less likelihood of further failure or delay from the balance of the worn or defective parts.

While trucks with A.R.A. cast-steel sides are rapidly supplanting other types in common use it will be years before the older cars are equipped. Therefore it is imperative that careful inspection be made of arch bars and box bolts to insure against failures. A tight journal-box bolt won't shear off. However, many of these bolts do shear off and result in costly accidents some of which could have been avoided if the bolts had been renewed or kept tightened. It is practically beyond the control of the car inspectors or light repairmen in the train yards to tighten all loose journal-box bolts as many of them have reached the stage where renewal is necessary due to the threads having been worn off and the element of time does not permit holding trains for other than light repair work.

Cracked or broken truck-bolster center plates are sometimes difficult to detect in train-yard inspection because on many types of cars the sill cover plates are located adjacent to the center plate and obscure the view of the rim or bowl. The average slack action of a freight train of 120 cars with a helper engine on the rear is sufficient to cause a car with a broken or defective center plate to be pushed off the center, shear off the center pin (if there happens to be one in place) and result in sideswiping a passing train or derail the car following at the first reverse curve in the track.

Elongated holes in brake-beam hangers subject them to failure

During periodic inspections the superstructure of box cars should be given a thorough examination and all siding that is broken or loose should be renewed. Also the flooring and lining should be replaced where it is found broken so as to prepare the car for the highest commodity which it is capable of hauling. Broken flooring or lining or protruding nails are responsible for many damage claims due to the tearing of bags or the raking of merchandise. The temporary repairs which were previously made, presumably by some foreign railroad, to side doors, door posts and their fixtures, should be removed and permanent repairs made and standard, burglar-proof fixtures applied.

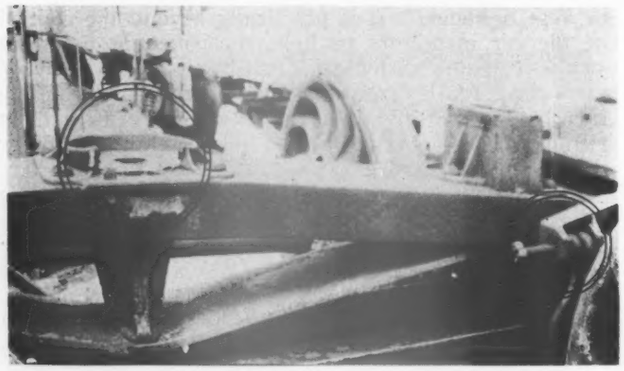
Every 30 days a locomotive is subjected to an inspection of "all parts, including the boiler and appurtenances" and "all defects disclosed by said inspection" are repaired. This inspection is mandatory by a ruling approved by the Interstate Commerce Commission.

While no 30-day inspection period is required for freight cars it is only reasonable to expect that a freight car should receive a periodical inspection at least once each 12 months to insure against wear and tear of con-

Improperly packed journal boxes are the cause of many train delays

cealed parts and the renewal of such parts as cannot be repaired in the train yards.

This can be accomplished by the car owners at the time their cars are on the home-road repair tracks making it unnecessary for foreign lines to shop cars out of trains, switch them to repair tracks and replace the



Broken center plates and worn brake-beam hanger pins are responsible for many car failures

failed parts with material which frequently is not standard to the car and which in many cases must be, or should be replaced by the owner when the car reaches the home line. It will further insure against delays and costly accidents both on home and foreign railroads and result in a much higher standard of freight-car maintenance on all railroads.

Car-Wheel Wagon

*By P. G. Stultz**

ONE of the heaviest operations in the maintenance of freight-car equipment is the application and removal of wheels. At West Roanoke, Va., the wheel-storage tracks are parallel to the repair tracks, making it necessary to have a cross track leading from the end of the storage tracks to the pole-car tracks. In transferring wheels from one track to another a right-angle turn must be made. This right-angle turn is accomplished with the usual type of wheel stick. Again, the wheels must be transferred from the pole track to the repair track, making it necessary to turn the wheels, and, in many cases, roll them across the ground.

To facilitate the handling of wheels a car-wheel wagon, drawn by a tractor, was designed and placed in operation at the West Roanoke wheel shop. With this wagon, wheels can be moved from one point to another and placed on any track desired.

The operation of this wagon is simple and practically automatic. The wheels are loaded by backing the lifting arm of the bell-crank under the pair of wheels. As soon as the wagon is in proper position the tractor operator applies the brakes on the wheel wagon and releases the sliding bar by lifting the lock lever. The tractor is moved forward and this move pulls the sliding

Wagon in service

bar and bell-crank connecting rod, which pulls the bell-crank arm forward sufficiently to raise the wheels from the ground. When the wheels are raised, the sliding bar comes to a locked position and, in doing so, the brakes on the wagon are released by a plunger attached to the sliding bar, and the wagon follows the tractor. To unload the wheels the operator of the tractor releases the sliding-bar lock, which allows the wheels to drop to the ground, and the wagon automatically closes.

* Mr. Stultz is car foreman of the Norfolk & Western at the West Roanoke, Va., shops. Illustrations are furnished through the courtesy of the Norfolk & Western Magazine.

Left: Wagon in open or carrying position—Right: Wheel wagon in closed or loading position

The wagon is of steel plate and bar construction, welded and riveted together, as shown. It is carried on two rubber-tired truck wheels which are provided with brakes operated by means of a hand lever.

Coach Repair Tracks

THE illustration shows the Chicago & North Western passenger-car repair tracks and shed at the California avenue (Chicago) coach yard. Any work heavier than the light running repairs, which are chalk-marked and can be made in the yard, is handled by a foreman and repair-track force at this point, the size of the force depending upon the average number of bad-order cars received daily. It will be observed that four of the repair tracks are under cover, an important feature when weather conditions are adverse. Three drop pits are provided and extend across all four tracks, two inside the shed and one outside. Each of these pits is equipped with an air hoist operating on rails to transfer defective wheels out and O. K. wheels in.

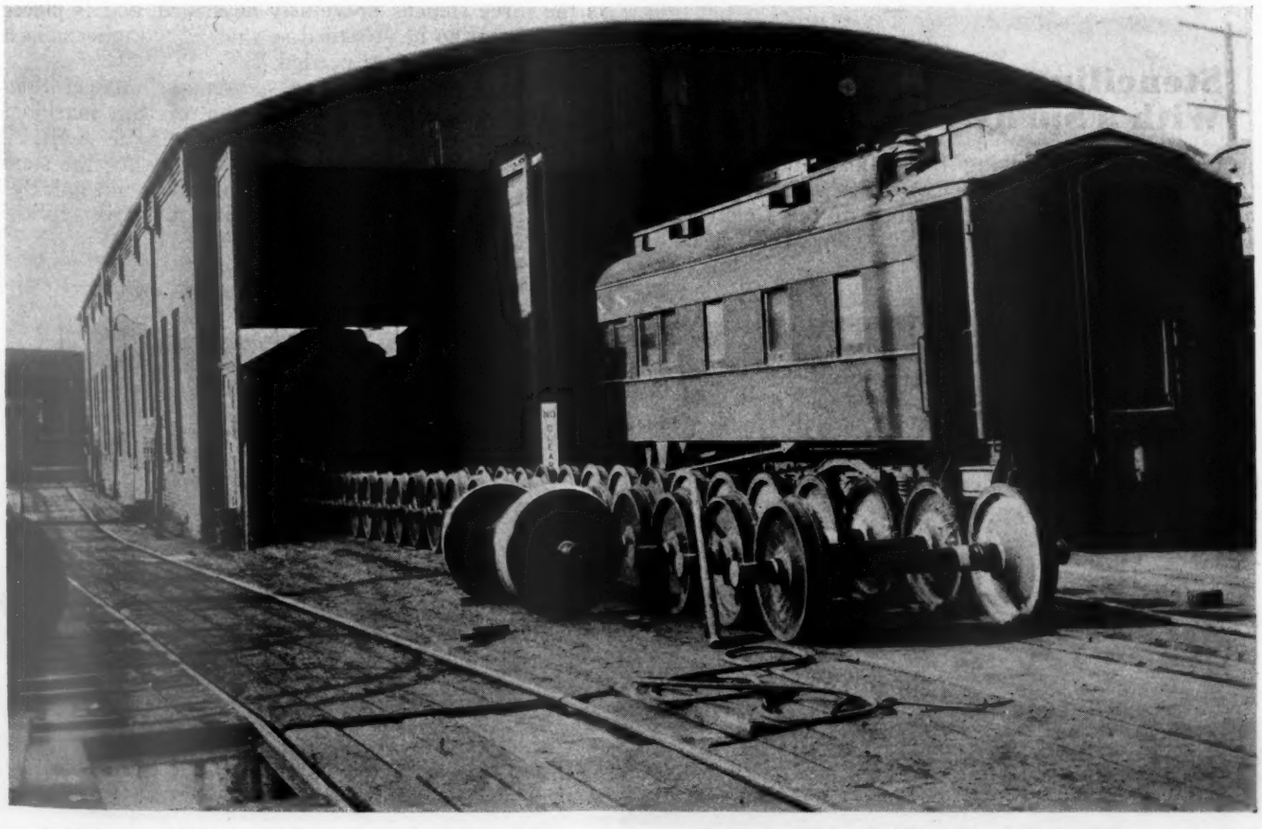
The truck-repair gang generally works in groups of four with one man in the pit to operate the jacks, remove brake connections, etc., the other men being employed on the ground to jack up the car body, remove tie straps, springs, pedestals, etc. A wheel lathe is available for turning wheels, but journals in bad order are re-conditioned at the back shop.

In general, all mounting, inspection and maintenance of roller-bearing boxes and parts, applied on a considerable amount of North Western suburban equipment, is done at the California avenue coach yard.

Questions and Answers For Air-Brake Foremen

Following is the seventh of a group of questions and answers selected from the instruction pamphlet recently received by an eastern railroad. The sixth series of questions appeared in the January, 1932, issue, page 31.

Q.—Explain how to make a general inspection of air-brake equipment. A.—Place the independent or straight air-brake valve in application position. If the engine is not equipped with straight air or independent brake, make a 20-lb. service reduction and place the automatic brake valve in lap position, and then make a general inspection. Note that piston travel is standard; that the foundation brake gear is in safe and suitable condition; that all reservoirs and brake cylinders are properly secured to brackets and brackets to the supporting member; that all parts are at least 2½ in. above the rail; all pins properly secured in place with cotters, split keys or nuts; that brake shoes are securely attached, in line with treads of wheels and not less than ⅜-in. thick at the thinnest point and that brake-gear members do not bind or foul; that the air hose points toward the center of the truck; that hose couplings, gaskets and dummy couplings are in good condition; that air hose are coupled to dummy couplings or supported by foot boards when not in use and those between the engine and tender do not rub together. All pipes and fittings should be tested for leakage by a torch, except on electric locomotives soap suds should be used. All leaking or loose pipes, fittings and clamps should be marked with chalk to indicate the exact place of defects or repairs; clamps should be applied if necessary to prevent vibration or wear by coming in contact with moving parts. Drain cocks in all cases should be tested and known to be in operative condition. In addition, water should be drained from all reservoirs and from other parts provided with drain cocks. Drain cocks should be provided with extension handles, when reservoirs are located between the frames of engines, and left open when engines are stored. Note that main-reservoir supports are maintained in condition to prevent vibration of reservoirs or related piping. Main reservoirs and related brackets and pipe connections should be excluded from inspection on elec-



Coach-yard repair tracks of the Chicago & North Western at California avenue, Chicago

tric locomotives except when all hazards incident to making inspections are removed. Place the brake valve in release position, take a firm hold of the air hose near the coupling and examine the gasket, then open the angle or cutout cock on each end of the engine, noting there is a heavy continuous discharge of air from the air hose and that the brakes release when the cocks are closed, except on engines with No. 5 ET equipment, or whenever the holding feature is maintained.

Q.—Explain how to obtain proper brake-cylinder value with A-1 equipment. A.—Adjust the driver-brake piston travel so as to develop 50 lb. brake-cylinder pressure on a brake-pipe reduction of 20 lb. from an initial brake-pipe pressure of not less than 70 lb.

Q.—What is the object of opening an angle cock or cutout cock with the brake valve in release position? A. To determine whether or not there is free circulation of air from the main reservoir to and through the brake pipe.

Q.—What should be noted with respect to electrically driven compressors? A.—That they do not pound, that the strainers are clean, piston rings free from leakage, that compressors and related pipe connections are free from leakage, that motor bearings are properly lubricated and that a sufficient amount of oil is in the compressor crankcase.

Q.—How may leaking rings be detected? A.—By observing the amount of air blowing from the crankcase vent pipe.

Q.—What should be observed with respect to increase of main-reservoir pressure? A.—That it increases at normal rate with the compressor or compressors running.

Q.—What should be noted with respect to steam-driven compressors? A.—That vibration is not excessive when run at normal speed; that compressors of the same capacity are maintained in all cases of double installation; that strokes are even and uniform; air strainers clean; piston-rod packing free from leakage; that air- and steam-cylinder gaskets do not leak; that steam end does not blow; that compressor- and air-pipe connections do not leak; that air cylinders are not excessively hot; that drain cocks are operative; that necessary lubricating attachments, including oil cups and related pioing, are provided; that piston-rod swabs are in good condition; compressors do not pound; no leaks in the steam-supply line; that main-reservoir pressure increases at a normal rate with the compressors running, and that do not groan.

Stenciling Cars With a Spray Gun

AN article describing 80,000-lb. capacity, single-sheathed, steel-frame box cars which were built at the Green Island, N. Y., shops of the Delaware & Hudson, was published in the November, 1931, issue of the *Railway Mechanical Engineer*, page 525. An eight-station spot system arranged to produce one complete car each day is installed at these shops. Painting is done at the last spot as the car goes out of the shop.

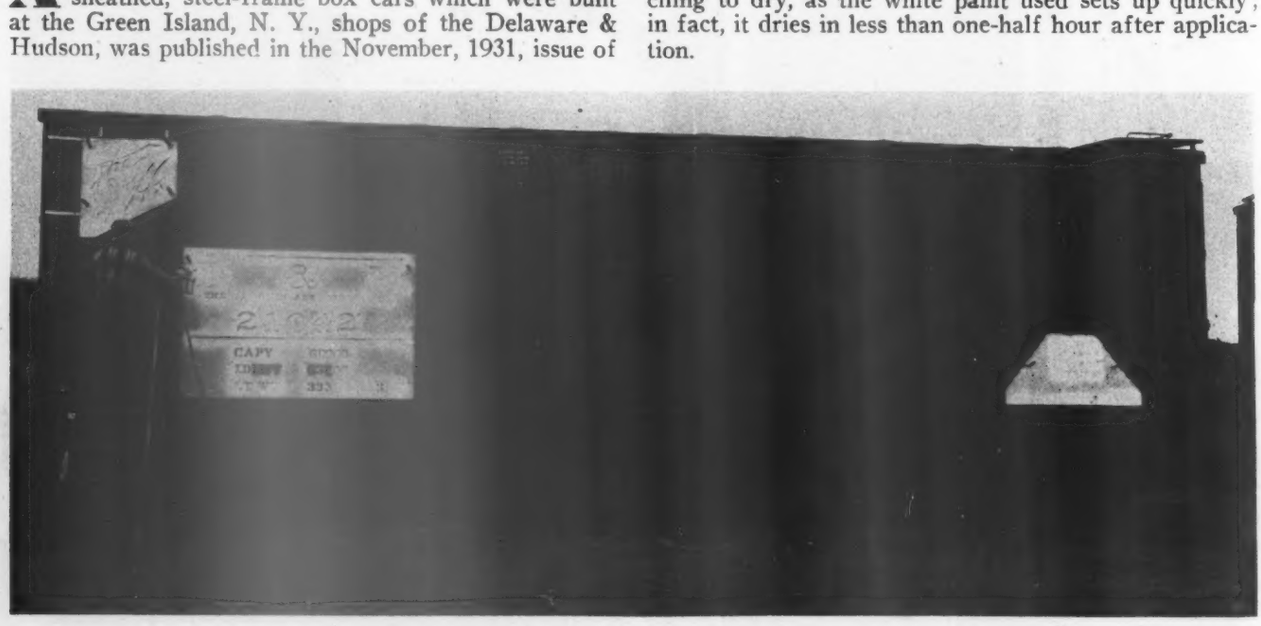
A feature of the work performed at this spot is that of stenciling. With the method employed, most of the work is done by air-operated spray equipment. It was formerly the practice to cut stencils out of paper and apply the required markings with brushes. By the new method, the use of stencil brushes is practically eliminated.

Stencils are made of galvanized sheet iron instead of paper and they will last for some time before requiring renewal. Three sheet-iron stencils are required for the complete marking of a car. The largest measures 6 ft. 4 in. by 4 ft. 6 in. This stencil sheet is provided with slotted openings to accommodate the numerals which are made of No. 9 gage sheet metal. The back of each is reinforced with fine wire which keeps it flat and firm. By means of the slotted arrangement, numerals may easily be removed and changed. The other stencil sheets do not require this arrangement for changing letters or figures.

The work of marking the box cars turned out at Green Island is performed by two men who are paid on the piecework basis. There is no delay, as each operation moves along smoothly without any lost motion. Brush stenciling is done, such as the ends of the car, air brake equipment and markings on the underframe where spraying is impracticable, is performed by one man, while the other man is engaged in applying the D. & H. monogram, rearranging the numerals, etc., in the large sheet-metal stencil, preparatory to the stenciling of the next car.

At the end of each day the stencils and numerals are cleaned with turpentine and replaced on the rack. This portable rack carries several sets of numerals, as well as the three stencils previously described, and is placed near the cars to be stenciled so that all paraphernalia is readily available when needed.

The spray stenciling system speeds up shop operations and insures a uniform application of the markings which cars are required to carry according to A. R. A. rules. Little delay is experienced waiting for the stenciling to dry, as the white paint used sets up quickly; in fact, it dries in less than one-half hour after application.

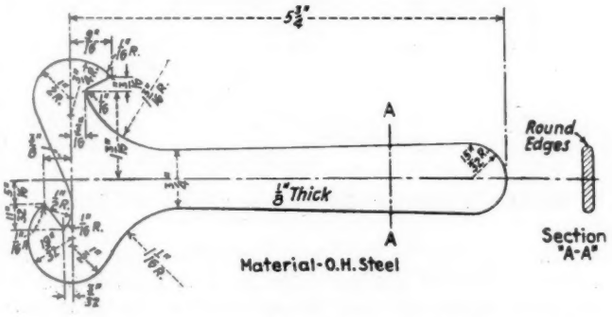


Stenciling a box car with spray-painting equipment and metal stencils at the Green Island shops of the Delaware & Hudson

The stenciling methods used on box cars in the Green Island shops proved so successful that they have been extended to the Oneonta, N. Y., shops where open-top equipment receives general overhauling.

Journal-Box Lid Opener

A HANDY TOOL for opening and closing the lids of journal boxes is shown in the drawing. The lower jaw is for opening and raising the lid and the top lug is used to pull the lid down to close it. To raise

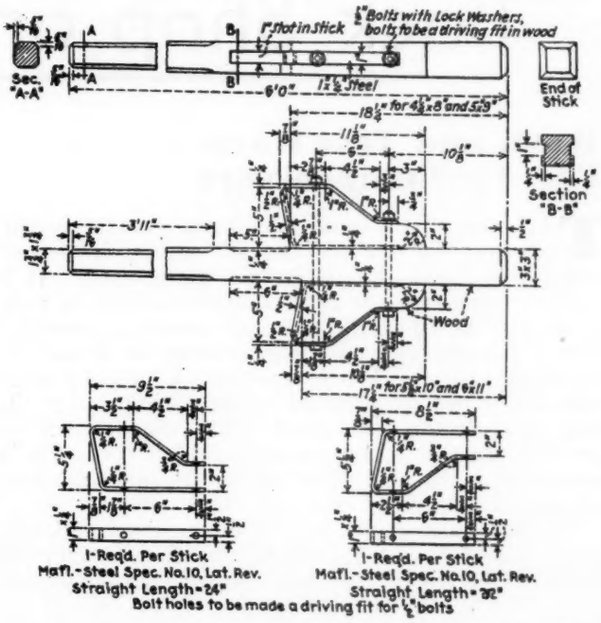


This handy tool makes it easy to open and close the lids of journal boxes

the lid the lower jaw is placed over the bottom edge of the lid. The curved top portion of the tool bears against the face of the lid and serves as the fulcrum or bearing point for the lifting operation. It is made of O. H. steel.

An Improved Wheel Stick

THE wheel stick, the details of which are shown in the drawing, was designed to facilitate handling mounted wheels with a minimum amount of damage to the journals. The collar of the axle fits in the ¼-in. groove in the stick and bears against the steel strap, which is bolted to the stick with ½-in. bolts. The groove prevents the journal from slipping off the stick. Lifting at the collar, instead of at some point on the journal surface, prevents any possible scoring or injury to the bearing surface. One side of the stick



A ¼-in. groove in this wheel stick permits lifting paired wheels at the collar of the axle journal with safety

is used for handling mounted wheels with 4¼-in. by 8-in. and 5-in. by 9-in. journals, and the opposite side is used for wheels having 5½-in. by 10-in. and 6-in. by 11-in. journals. The wood member is of oak, free from knots and other defects, and the stick is painted black.

THE PENNSYLVANIA'S BROAD STREET STATION—Fifty years ago, when it was first opened, the Pennsylvania's Broad Street Station in Philadelphia was the largest and most imposing railroad terminal building in America. Now its accommodations are scarcely as large as those afforded by the new suburban station recently opened on Sixteenth street, and they are quite unimpressive in comparison with the accommodations which will be provided in the new station at Thirtieth street when it is completed. During the fifty years in which it has been one of Philadelphia's landmarks, the Broad Street station has accommodated more than 500,000,000 passengers.

* * *

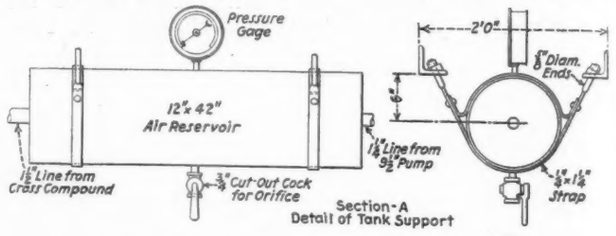
Hump yard on the Lehigh Valley at Coxton, Pa.

In the Back Shop and Enginehouse

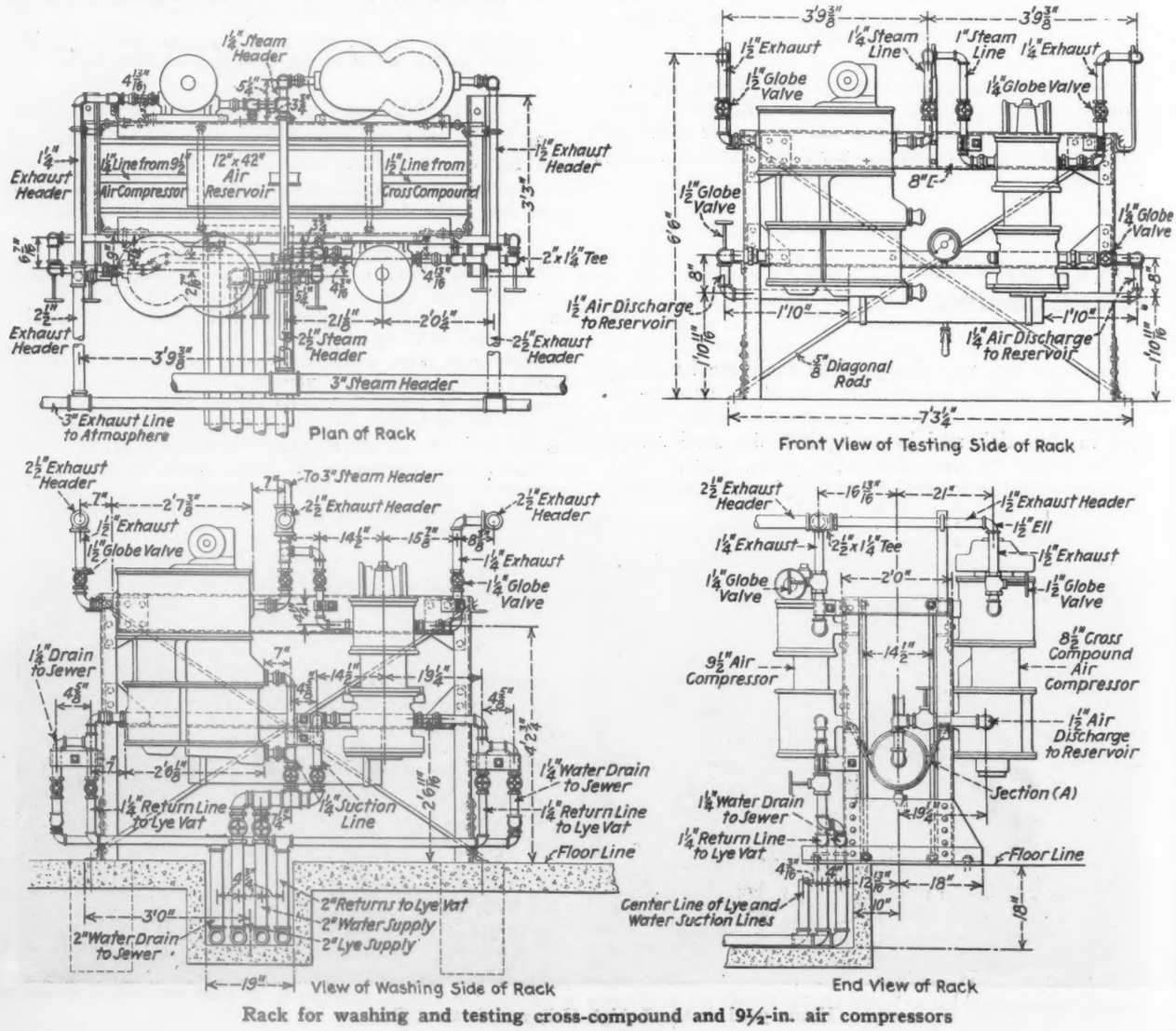
Wash and Test Rack For Air Compressors

THE rack shown in the drawing is used by an eastern railroad for washing and testing cross-compound and 9½-in. locomotive air compressors. It is made of scrap angles and plates braced with ⅝-in. rods, as shown. A 12-in. by 42-in. air reservoir, provided with a pressure gage, is slung between the frames by means of ¼-in. by 1¼-in. steel straps. Pipe connections to the two compressors on the testing side of the rack are made from either end. A 1¼-in. pipe receives air from the 9½-in. compressor, and a 1½-in. pipe is connected to the air end of the cross-compound compressor.

The two compressors may be mounted on back-side of the rack for washing. Two-inch pipe lines for the return to the lye vat, for water supply, lye supply and water drain to the sewer are laid in a pit 19 in. wide. The steam supply is received through 3-in. and 2½-in. pipes, which connect at a point directly above the two branch pipes that lead to the steam ends of the two compressors. Valves are provided in each branch pipe so that the compressors may be operated at the same time



Method of slinging the air reservoir to the frames



Rack for washing and testing cross-compound and 9½-in. air compressors

or individually, as desired. The lye or other cleaning compound is circulated through the compressors for washing. On the completion of this operation the valves in the 1¼-in. lye supply and return pipes are shut off and the valves in the water supply line and connection to the drain are opened for rinsing.

With this rack both the cleaning and testing operations can be handled at the one location and the necessity of moving the compressors from one part of the shop to another for these jobs is eliminated.

Power Trucks Save Labor on E. J. & E.

As a result of installing over 20 power-operated trucks and tractors, with a correspondingly adequate number of trailers, skid platforms and stock boxes, the Elgin, Joliet & Eastern has effected important savings in the labor of handling materials required for both locomotive and car-maintenance work.

Mechanics are no longer permitted to go to the storehouse, the material for locomotive repairs being ordered by a foreman on store orders, which designate the particular locomotive or machine at which the material is required. These orders are placed on hooks and picked up at stated intervals by stores department material men, and the material is delivered directly to the job on platforms and boxes, handled by crane trucks or trailers hauled by tractors.

Summary of Savings at Joliet

The total cost of trucks and hand trucks, skid platforms and boxes		$27,430
Concrete roadways		11,550
Total		$38,980
Gross savings in labor	$46,428	
Less 10 per cent for depreciation	$3,898	
Less 5 per cent maintenance, taxes and insurance on investment	1,949	
Less 6 per cent interest on investment	2,338	8,185
Net saving for one year		$38,243

Crane trucks with an extended boom are used in the enginehouse for removing and applying locomotive parts and also for hauling material to the machine and forge shop and for loading locomotive scrap into special scrap cars located adjacent to the enginehouse. At smaller terminals, this type of crane is used to handle all large items of material for the locomotive, car and stores department, and is a great labor saver.

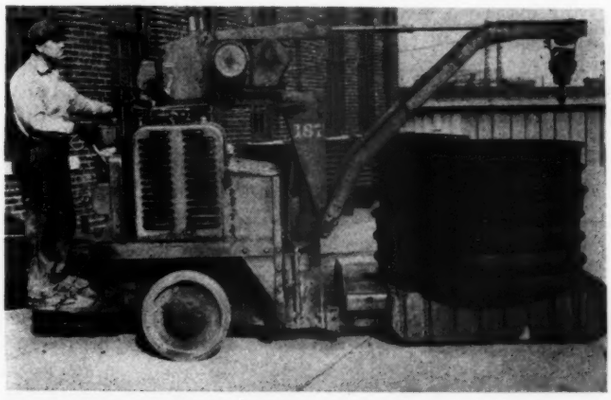
View illustrating the adaptability of a crane-equipped truck in handling awkward material

Welding gases are distributed each morning to the shops on trailers and all filled or partially-filled cylinders are picked up each night, approximately 15 to 20 min. before closing time, and returned to the gas storage.

In the storehouse, material is handled with the aid of hand-jack truck lifts and crane trucks. All scrap brass is shipped to the foundry, and springs for repairs are forwarded to the spring manufacturer in containers and new material returned in the same containers. In handling other carload material, the containers are placed in the cars and such material loaded into or onto these boxes or platforms and placed in the storehouse or on material storage platforms by lift trucks.

In delivering material to and from the machine shop at Joliet, one operator with a gas-electric lift and crane truck costing $3,854, does the work previously performed by narrow-gage equipment requiring the services of an operator and helper, effecting a labor saving of 47 cents an hour.

One operator with this truck can also handle material such as front deck castings, trailer tires, engine springs, side rods and such heavy articles without assistance, at a saving of approximately two hours of labor per day for loading. This crane also handles containers loaded with scrap brass which is accumulated in the machine shop and brought to the storehouse. The measurable reduction in labor charges is $1,422 per year, and the new method is much safer and quicker than the old method.



Power truck and skid used in handling driving-wheel tires

Another lift truck, gas-operated, unloads brass locomotive castings which are now being received from the foundry in skid boxes, the skids being loaded at the Joliet storehouse with scrap brass and returned to the foundry, which reloads the skids. This truck handles shipments of new and reclaimed springs in the same way and also delivers arch brick and miscellaneous castings in skid boxes to the enginehouse, and air hose, triple valves, angle cocks, etc., to the air room. A summary of the measurable savings at Joliet is shown in the table.

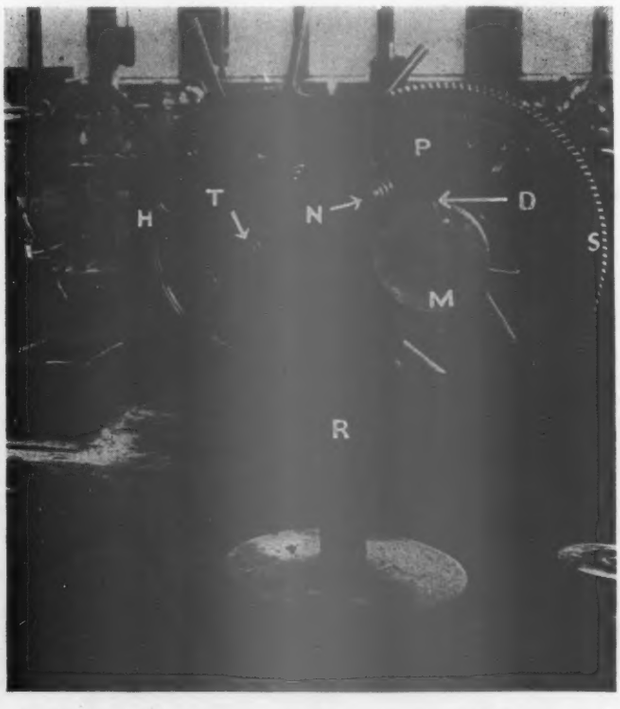
THE FIRST STEAM ENGINE.—Who did build the first steam engine in the world? Ordinarily credit is given to James Watt, but the director of the Technical Museum of Stockholm, Sweden, has other ideas. He says that the first steam engine was built in 1728, eight years before the birth of James Watt, and its constructor was Maaron Triewald, a Swedish professor of astronomy. The Swedish professor's steam engine is supposed to have been used for seven years at the mines in Dannemora in central Sweden, until lightning destroyed it in 1735.

Pipe-Bending Machine

A RUGGED, portable, pipe-bending machine, designed and built at the Milwaukee shops of the Chicago, Milwaukee, St. Paul & Pacific, is shown in the illustration. It consists of a scrap piston head and rod with the nut burned off to give the head a flat bearing on the shop floor, the pipe-bending mechanism being mounted on the upper end of the rod.

Piston rod *R* is milled on one side to give a flat bearing surface for the forged-steel adjusting plate *P*, 14 in. by 27 in. by 1½ in. thick, drilled with 1¾-in. holes to accommodate the idle roller *N* in various positions as required, depending on the size and location of the pipe bend to be made. The adjusting plate is firmly secured to the piston rod by means of two U-clamps, the four recessed nuts on the clamp ends being shown in the illustration. Large roller *M*, provided with a 2-in. half-round groove in its circumference, is keyed to a 2½-in. shaft, which has a well-lubricated bearing in adjusting plate *P* and is keyed to the cast-iron spur gear *S*. This is a 4-pitch gear, with 134 teeth, 3-in. face, outside diameter of 34 in. and pitch diameter of 33½ in. A 4-pitch, 16-tooth pinion, of 4½-in. outside diameter, engages gear *S*, being pressed into hand wheel *H* and revolving freely on handle post *T*. Wheel *H* is built up of a cast-iron wheel with 12 pipe handles riveted in place as shown. Strap *O*, attached to large roller *M*, engages the pipe, holding it against the roller during the bending operation.

Ample power is available in this machine, with a gear ratio of 33½ to 4, to bend pipe up to 2 in. in diameter. Pipe sizes up to 1½ in. can be bent cold to a minimum radius of 4¾ in. An important feature in the satisfactory bending of pipe with this type of machine is to make the groove in roller *M* slightly deeper (about ⅛ in.) than one-half the diameter of the pipe. In other words, the groove is slightly elliptical in shape and, when maximum pressure is exerted tending to flatten the pipe, it is simply forced further into the groove without being deformed. By means of special jigs, made to hold superheater unit ball joints, superheater pipe can also be bent cold on this machine and to a very desirable degree of uniformity. The pipe bender is portable and can be readily moved by means of a crane or truck to any point in the pipe or erecting shops most convenient for the work in hand.



A convenient, portable pipe-bending machine of rugged construction

Pipe-Bending Vise

In addition to a thoroughly-dependable pipe-bending machine, another important requirement in any pipe shop is a rugged vise with not less than 8-in. jaws rigidly mounted so that it can be used in the hot bending of large pipes up to 6 in. in diameter, now sometimes used on locomotives. Every experienced pipe shop foreman and worker knows what a handicap it is to be without at least one rigidly-mounted vise located near the center of the pipe room where he can get around it conveniently from all sides to clamp and bend pipes of all lengths. Wobbly work benches, weak pilasters and building supports, to which vises are sometimes attached, are totally unsuited to hold vises as rigidly as required in modern pipe shop practice.

The way in which this problem has been met at the Milwaukee shops is to bolt the vise securely on a 30-in. by 30-in. steel plate, welded to the top of a scrap car axle, the bottom end of which, with the car wheel still in place, is enclosed in a heavy concrete block beneath the shop floor. The car wheel is set deep enough so that the steel plate projects about 30 in. above the floor near the center of the pipe shop where ample room is available to bend pipes without interference. The steel plate is rigidly braced and secured by electric welding to the car axle. With this construction, the vise support is rigid and, in some cases, where 20-ft. or greater lengths of large pipe are to be bent, they are heated at the desired point, clamped in the vise and an electric truck or tractor used instead of man-power to do the actual work of bending the pipe. Without a rigidly-supported vise and without ample room in which to work, this operation would, of course, be impossible.

Portable Tool for Boring Reverse-Shaft Bearings

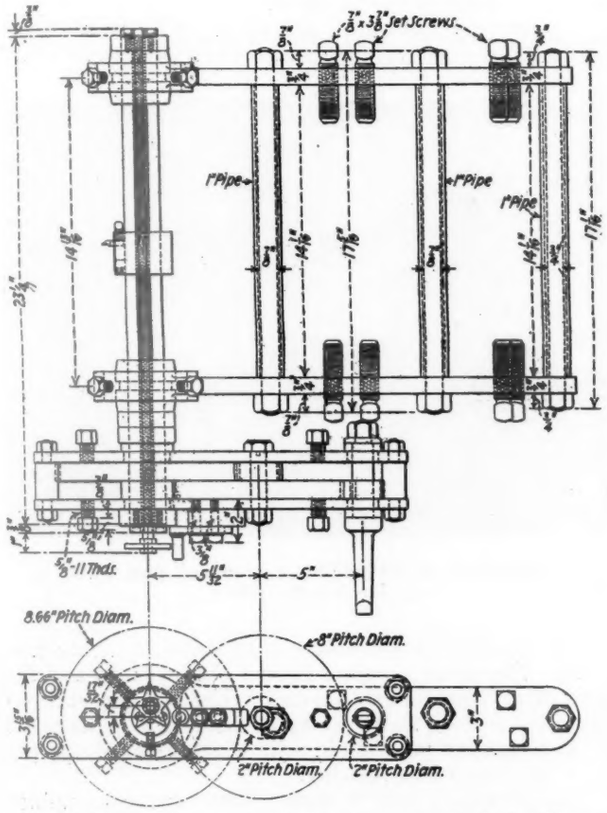
THE portable tool shown in the drawing is used by a southern railroad for boring reverse- or lift-shaft bearings with the bearing castings bolted in place to the frames of a locomotive. The device is clamped to the frames by means of the ⅞-in. set screws. To set up for operation, the cutting tool and feed-screw assembly are slipped from the inside adjustable bearing and pulled to the outside a sufficient distance to clear the work. The machine is placed in position on the frame, the cutting tool assembly is replaced, alined to the approximate center of the bearing, and the frame set screws are tightened.

Power is provided by means of an air motor, the socket of which fits over the mandrel shown. The mandrel is keyed to a 2-in. diameter gear which meshes with a larger gear, 8 in. pitch diameter. On the same shaft with the 8-in. gear is another 2-in. gear which meshes with a gear having a pitch diameter of 8.66 in.

This gear is keyed to the slide or operating shaft. The feed screw, which has square threads, is located in a groove which extends the length of the operating

shaft. A square fit is machined on the end of the feed screw for a star wheel, which engages an adjustable stop. As the operating shaft rotates, the points of the star wheel engage the stop, which in turn revolves the feed screw. The rate of feed is regulated by adjusting the amount of contact of the stop with the star wheel, as shown.

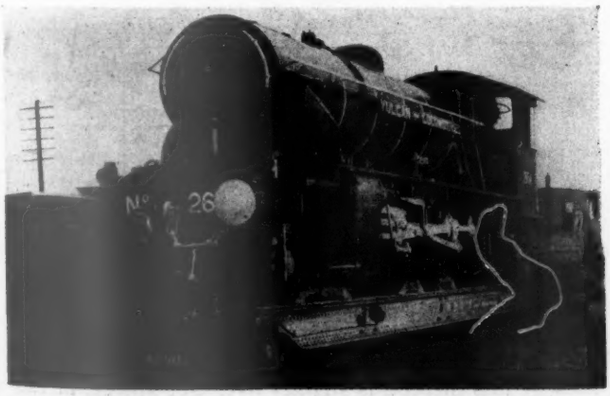
The movement of the toolholder, which is secured to the operating shaft by a feather key, is regulated as desired by the feed-screw, star-wheel and stop arrange-



Portable boring bar for boring reverse-shaft bearings on the locomotive

ment. Four set screws in each of the two bearings, the ends of which engage a groove in the revolving portion of the bearing, provide for final and accurate setting of the cutting tool and operating shaft to the reverse-shaft bearings.

* * *



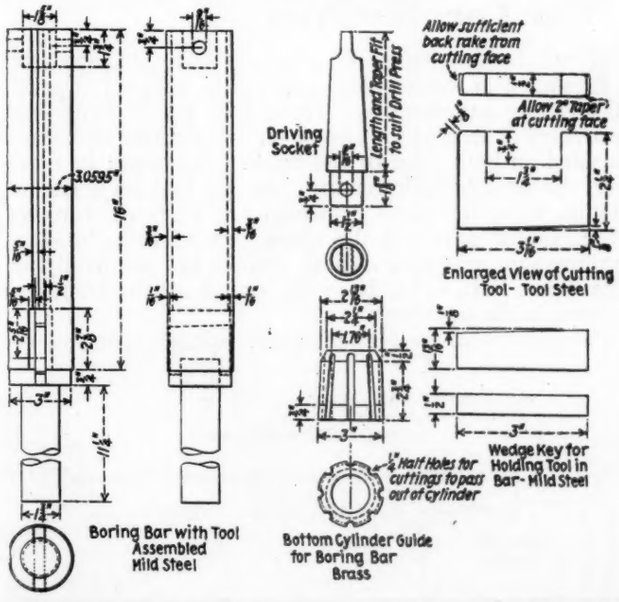
A 62-ton locomotive being transported from the builder's plant to the wharves in Liverpool, England, by motor truck

Boring Bar for Fire-Door Cylinders

THE boring bar shown in the drawing was designed to bore fire-door cylinders which had become so badly worn that the rings could not be properly fitted to prevent leakage. Reclaiming these cylinders by boring on a lathe was tried, but difficulties were experienced in that it required a long, slender boring tool to reclaim a cylinder 12 in. in length. Another bad feature was that it required too much time to check one of these cylinders for boring on a lathe, and when it was bored the result was uneven. This fault is due to the fact that there is a slot in the cylinder which causes the tool to jump, chip and dig when it encounters this slot in the process of boring.

When these cylinders are repaired and placed in service again, certain facilities are necessary for the work and when a shop does not have an internal grinder for this type of work a boring bar of the type described is most economical and practicable. This bar is an old idea, but adapted to a new job.

The cylinder is set up on a drill-press angle plate and alined as nearly perfectly as possible. Any imperfection in the set-up is taken care of by the part-universal joint of the boring bar. The boring bar is inserted in the cylinder and connected to the driving shank by a rough ½-in. bolt. The bottom cylinder guide is then inserted from the bottom of the cylinder bore and driven in until it is sufficiently tight. The


3.0595"
Boring Bar with Tool Assembled Mild Steel
Driving Socket
Length and Taper fit to suit Drill Press
Allow sufficient back rake from cutting face
Allow 2° Taper at cutting face
Enlarged View of Cutting Tool - Tool Steel
Wedge Key for Holding Tool in Bar - Mild Steel
½" Half Holes for cuttings to pass out of Cylinder
Bottom Cylinder Guide for Boring Bar Brass

Drill-press boring bar for boring Franklin No. 8A and No. 8B fire-door cylinders

boring set-up is now complete and the drill press is started at a speed of 12 r.p.m. and a feed of 0.062 in. As the boring is commenced, the bar is guided at the bottom and the top and, as the boring continues, it finally pushes the bottom guide out of the cylinder just before the cutter finishes its cut. After this, the bar is guided by the 3-in. diameter and the new diameter of the boring bar; namely, 3.0595 in.

This boring operation can be either a dry cut or cooled with soda-water lubricant, the same as that used on turret lathes. The latter produces a satisfactory surface, which is true and perfect within .002 in. The entire operation of reclaiming a cylinder in this man-

ner requires 30 min., which includes the set-up. This is quite a saving when compared with from three to four hours on a lathe. Even then the accuracy of the bore is not as satisfactory as that with the boring bar. A faster speed can be used on the boring bar, but it is liable to injure the bar cutter by heating, so 12 r.p.m. is desired.

The boring bar is made of mild steel and with two slots in the sides opposite each other so that the cooling solution may be carried to the cutter. The bar is driven by a standard tapered drill shank salvaged from the scrap bin and machined as shown in the drawing. The boring bar is connected to the shank by a rough ½-in bolt. The fit of the shank to the boring bar has ⅛-in. clearance and in this manner it acts as a universal joint. The cylinder does not have to be in perfect alinement to produce perfect work.

The finished size of $3\frac{1}{16}$ in. is desired to get the cut under the glazed surface of the old 3 in. diameter and true up the worn spots in the ring end of the cylinder. Rings $3\frac{1}{16}$ in. in diameter can be secured to fit the new cylinder.

To complete the job of reclaiming such cylinders and put them in good operating condition, it is necessary to build up on the piston by acetylene welding and finally turn them in a lathe and reface the ring grooves, which makes a very neat job.

Outside Blow-Off For Locomotives

THE outside blow-off piping and sump arrangement shown in the two drawings can be adapted to practically any enginehouse. Three 2-in. Barco joints are provided in each of the two boiler connections which are located on both sides of the track. When not in service, the flexible boiler connections are laid on a frame, 15 in. high, the posts of which are made of 4-in. by 4-in. yellow pine and the cross-piece of 2-in. by 4-in. yellow-pine material. These frames are set firmly in the floor, 9 ft. 6 in. from the center of the track, as shown in the drawings.

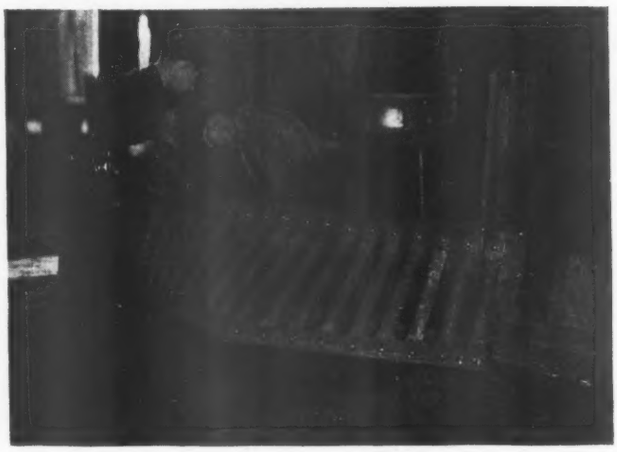
The sump can be located in any suitable spot outside the building and discharged into the sewer, or on the ground. All of the pipe used in the blow-off installation should be extra-heavy wrought iron. All fittings 2½ in. and over should be of extra heavy semi-steel and flanged. All screw fittings 2 in. and under should be extra heavy cast iron.

Fabricating Locomotive Pilot

By Shop Foreman

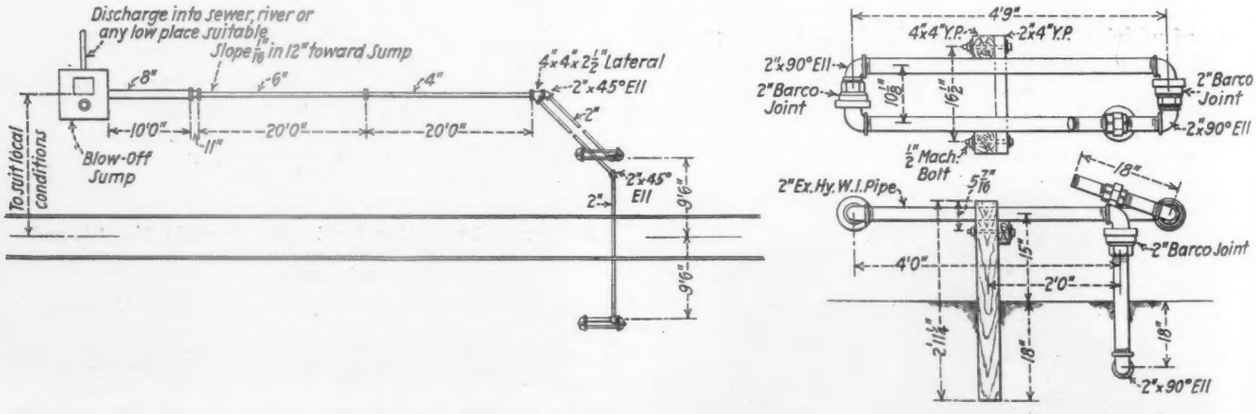
THE illustration shows a standard pipe pilot made almost entirely of scrap boiler tubes and flues and combining strength, relatively light weight and an unusually neat appearance. The steps, made of ¼-in. tank steel or ash-pan flare, are the only parts not constructed of scrap flue material.

The two uprights are made of superheater flues, cut to the proper length, flattened cold, heated and formed to the required shape under a hydraulic flanging machine. The cross support, bottom channel iron and the nose piece are similarly formed. The straight sections are composed of short pieces of boiler tubes, flattened on each end and punched in a jig which gives the proper angle and rivet-hole spacing.



Operation of assembling a standard pipe pilot for locomotives

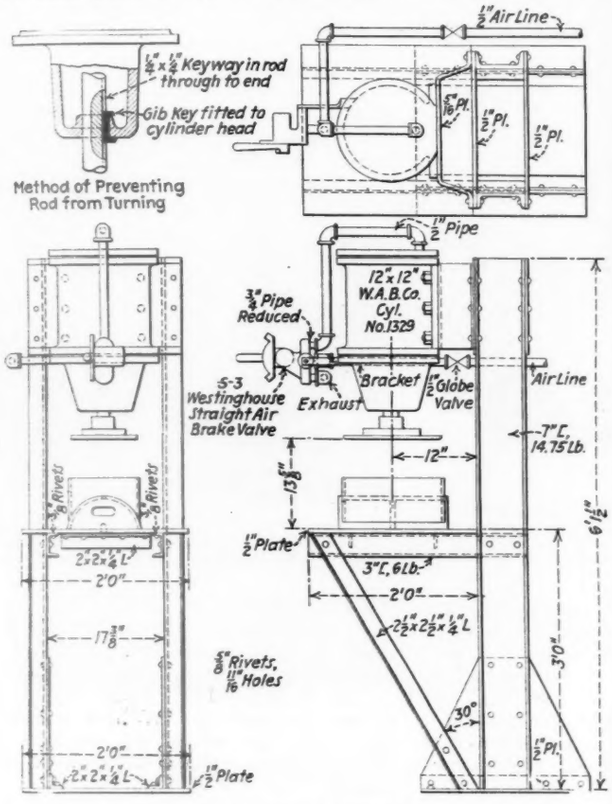
Approximately ten of these pilots can be assembled in an eight-hour day by two men, one of whom operates the pneumatic hammer, the other "holding on." Since this design of pilot is standard, the material can be prepared for 50 or 100 pilots at a time with important savings in time and labor. The unit cost of manufacturing pilots by this method is slightly over $11 apiece, including labor, material and a 10-per cent charge for shop handling and overhead.



Pipe and sump arrangement for an outside blow-off for locomotives

Press for Forming Grease Cakes

THE press for forming grease cakes, shown in the drawing, is of simple design and can be constructed of scrap materials from practically any car or tender repair shop. In this instance, the frame column is a 7-in., 14.75-lb. channel, which is braced to the floor or base plate by ½-in. gusset plates. The table is of



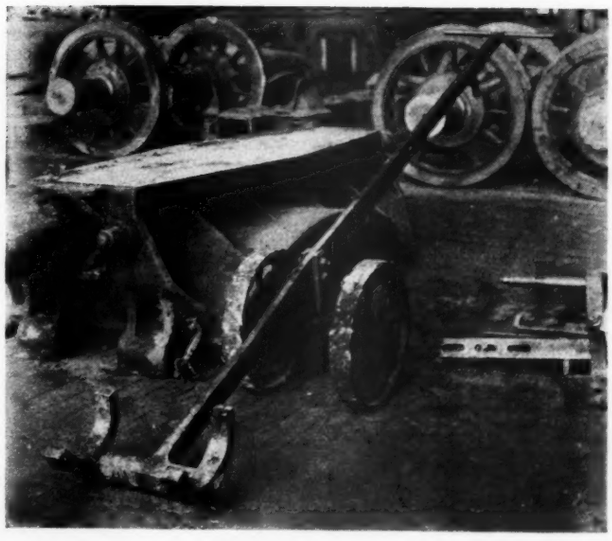
Grease-cake press which can be made from scrap materials

½-in. plate, laid on two 3-in., 6-lb. channels and braced with two 2-in. by 2-in. by ¼-in. angles. The diagonal braces are of 2½-in. by 2½-in. by ¼-in. angles.

Power is provided by means of a 12-in. by 12-in. Westinghouse brake cylinder, which is supported to the frame column as shown. A Westinghouse straight-air brake valve is used to operate the press.

Binder Cart for The Back Shop

THE binder cart shown in the illustration has proven advantageous for transporting and putting up binders on locomotives. It consists of a 10-ft. section of 1-in. by 6-in. steel forged to form a lever and binder carrier. This is mounted on the axle as shown which in turn is carried on two 18-in. wheels of cast iron. The fulcrum point over the axle is located 4 ft. from the binder carrier. The two vertical bars which fulcrum the arm to the axle are of 1-in. by 3-in. steel 8-in. high, bolted as shown. The carrier arms for the binder are made of 1½-in. by 3-in. bars, shaped as shown. These arms are welded to the ends of the cross piece which is forged from 3-in. by 3-in. steel stock, 18-in. long. This cross piece is welded to the end of the lever bar of the

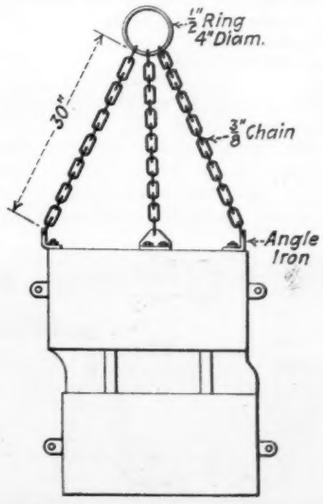


A handy two-wheel cart for putting up binders

cart. A handle bar is welded to the opposite end of the lever to facilitate balancing the binder especially when lifting it into position on the locomotive.

A Safe Way To Handle Compressors

SHOWN in the sketch is a simple and safe way to handle air compressors around a shop by overhead crane or crane truck. The feature of this chain and ring arrangement is the three pieces of angle which are



This chain and angle arrangement ensures safe handling of air compressors

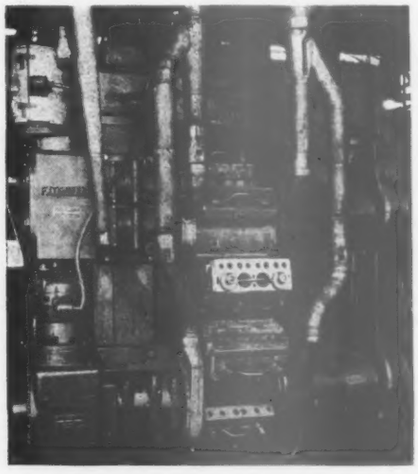
secured to the end link of each chain. The horizontal leg of each angle is bolted to the top end of the compressor, as shown. The T-head bolts and nuts used to secure the top head to the compressors are used to bolt the angles.

SPEAKING OF HEAVIER LOADING—A motor truck stopped by a state motorcycle officer at Dolton, Ill., early one morning was found to weigh, including its load of structural steel, a total of 57,000 lb. The load consisted of two bridge girders, each weighing 20,000 lb.

NEW DEVICES

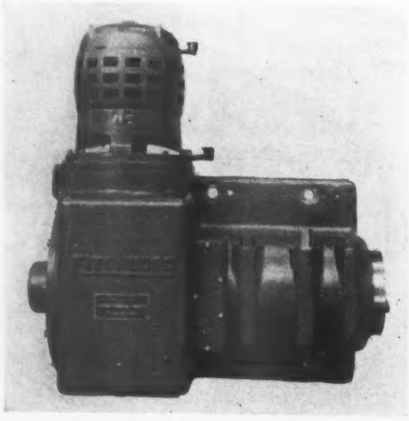
Fitchburg Millers With Unit Heads

Where it is desired to combine large output with low cost, planing operations have been largely superseded by milling. Production milling is a matter of arranging a required number of milling units, each with its cutter of proper size and rotative speed, in its proper relation to the work required, so that for a single set-up a maximum number of surfaces



Drum type milling machine for automobile cylinder blocks showing the application of one single-spindle and one double-spindle Fitchburg milling head

may be finished. The number of cutters which may be used at one time depends upon the size and shape of the parts to be finished, upon the production required, and upon the mechanical difficulties and cost involved in producing the machine. Until recently it has been the practice among milling-machine manufacturers to drive from a single motor. This method requires expensive mechanisms for transmitting power to the various spindles, especially when several spindles are required



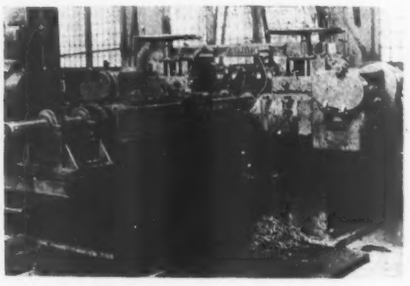
The self-contained milling head

and when their positions are at awkward angles to each other.

The Fitchburg Engineering Corporation, Fitchburg, Mass., has recently placed on the market a milling head with a self-contained power unit which may be operated in any required position, thus reducing the mechanical difficulties in producing special production milling machines to meet all requirements for production milling. This milling head can be arranged for permanent mounting or placed on suitably gibbed slide surfaces so they can be adjusted or fed along their supporting member as required. The spindle and spindle-drive member are mounted in precision Timken bearings. Drive of the spindle is by a chilled phosphor-bronze worm wheel engaging a hardened and ground steel worm. The spindle speed is varied by means of pickoff gears.

Two of the illustrations show a special milling machine recently delivered to a locomotive repair shop. This machine is arranged for repair work on locomotive crossheads and driving boxes. It illustates the simplicity and ruggedness of this type of construction.

Another illustration shows how two



The two-head horizontal miller arranged for machining locomotive crossheads

Fitchburg milling heads have been applied to a machine in an automobile plant in Detroit, which it was desired to modify to take care of certain changes in the design of the castings which it is used to machine. Without interference with the rest of the machine, it was possible to make the changes required.

Thus the builder is in a position to furnish complete milling machines to meet all special requirements, or to supply heads and feed mechanisms for converting existing milling machines.

Fitchburg two-spindle, horizontal milling machine, with mechanical table feed

Testing Device For Brake Cylinders

The Westinghouse Air Brake Company, Pittsburgh, Pa., has recently developed and placed on the market a portable device for testing brake cylinders and retaining valves. This device provides a simple and easy method of conducting the brake-cylinder and retaining-valve leakage tests as prescribed by A. R. A. rules for "Maintenance of Brake and Train Air Signal Equipment"—Rule 102 for "In Date" cars and Rules 124 and 164 for "Annual Repairs." It eliminates the difficulty usually encountered in applying a gage to the retainer or triple exhaust and probable test inaccuracy due to gage distortion or awkward location of the tester.

It is only necessary to break the retaining-valve pipe union and apply the two clamps, as shown in one of the illustrations, the gage clamp to the triple-

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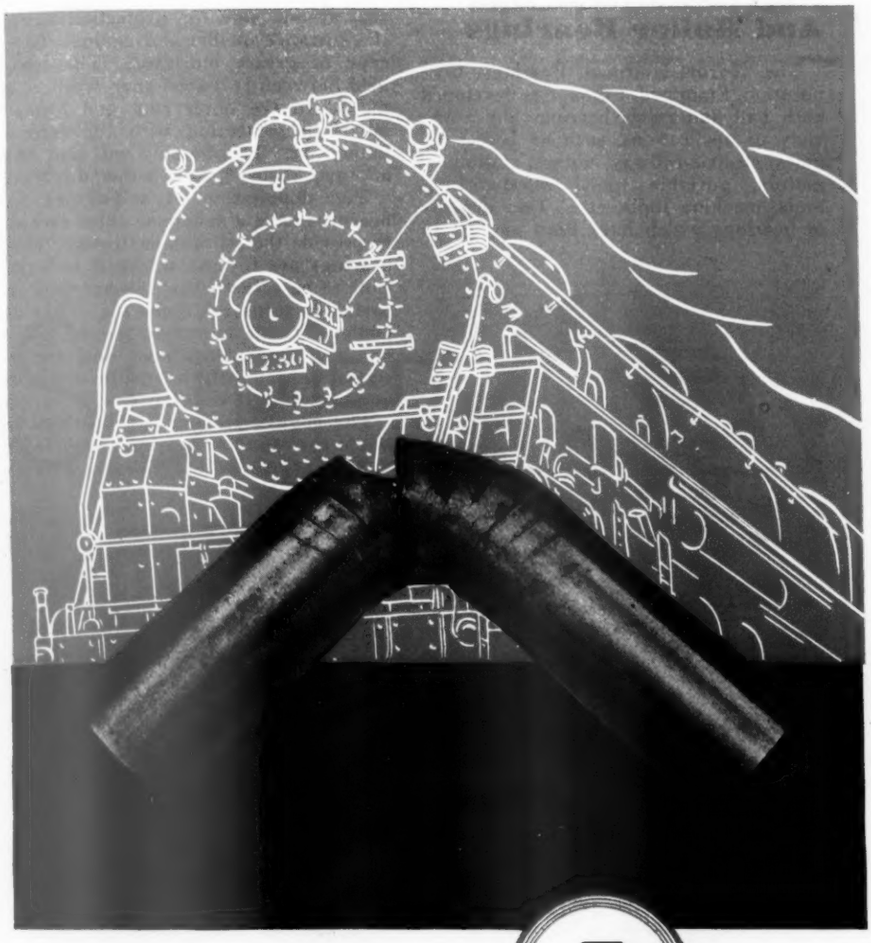


A TOUGH PIN

It's a tough pin that will take a bend like this after being case hardened to a file hardness on the surface. « The case is good and deep, too, and the core of the pin is tough enough to stand the hard knocks of railroad service. « It's Agathon Nickel Iron, quenched right out of the case hardening pot and ready for service in brake rigging, spring rigging pins or motion work. « Nearly 1000 tons of Agathon Nickel Iron are already in service.

AGATHON NICKEL IRON

Toncan Iron Boiler Tubes, Pipe, Plates, Rivets, Staybolts, Tender Plates and Firebox Sheets
Sheets and Strip for special railroad purposes
Agathon Alloy Steels for Locomotive Parts
Agathon Engine Bolt Steel • Nitralloy
Agathon Iron for pins and bushings • Agathon Staybolt Iron • Culverts • Climax Steel Staybolts
Upson Bolts and Nuts • Track Material, Maney Guard Rail Assemblies • Enduro Stainless Steel for dining car equipment, for refrigeration cars and for firebox sheets
Agathon Nickel forging Steel (20-27 Carbon)

CENTRAL ALLOY DIVISION

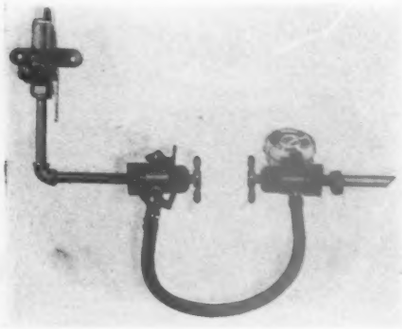
REPUBLIC STEEL CORPORATION

MASSILLON OHIO

valve side and the cut-out-cock clamp to the retainer side of the union. The thumb screws *6* are then tightened to hold the two sides of the union seated in the clamps while connection between the retainer and triple is maintained through the flexible hose.

Tests then are conducted in proper sequence. Brake-cylinder leakage tests (Rules 102 and 124) are made by closing the cut-out cock *8* in the hose line and reading the gage drop; combined brake-cylinder and retaining-valve leakage (Rules 102 and 164) is recorded by the gage drop with this cock open.

After completion of the tests, both the test cut-out cock and the drain cock



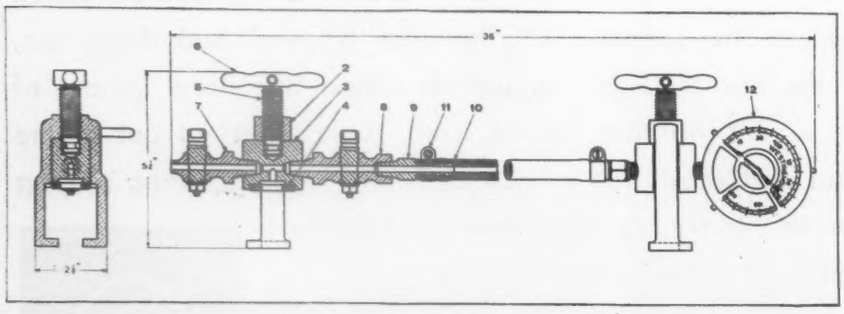
Portable testing device for brake cylinders and retaining valves

7 should be opened and the brake-cylinder pressure blown down, after which the test device may be removed with safety.

This apparatus offers a time-saving method for these necessary leakage tests. No additional work is involved in applying it as the retainer-pipe union usually is broken, at least in the case of annual repairs, when the triple valve is removed from the car.

Breaking the union is less laborious than crawling beneath the car to apply the gage to the triple-valve exhaust or clambering to the top to apply it on the retainer exhaust. With the test device the gage position is fixed and no strains are placed on it at any time. Tests, therefore, are reliable at all times, not only in extent, but also in location—the point of leakage, whether in the cylinder, retainer or retainer pipe, is definitely located.

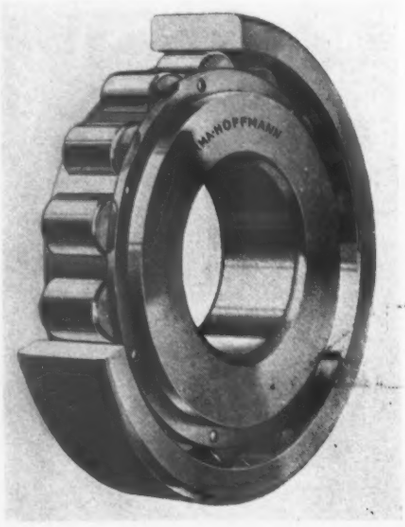
A light weight of approximately 6 lb. makes the device conveniently portable.



Sectional view showing the construction of the testing device

Norma-Hoffman Ball And Roller Bearings

The Norma-Hoffman Bearings Corporation, Stamford, Conn., has developed both ball and roller bearings for a variety of applications, such as Diesel engines, electric-railway motors, stationary motors, portable tools, woodworking tools, machine tools, etc. Two designs of bearings which have been applied to



Norma-Hoffman precision roller bearing for heavy-duty service

electric railway motors now on the Great Northern are illustrated.

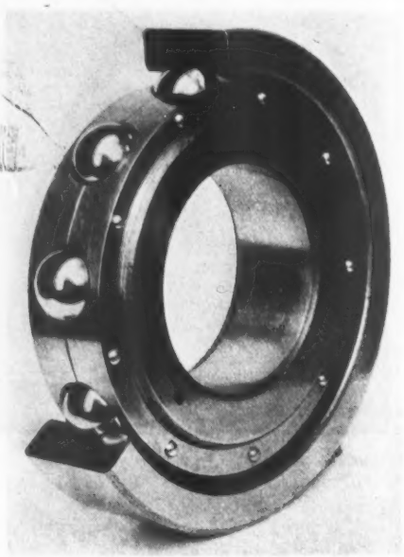
The open- or separable-type ball bearings manufactured by Norma-Hoffman are single-row annular ball bearings which can be easily separated into their component parts for inspection and cleaning. The bearings are equipped with one-piece well-balanced brass retainers, permitting them to operate at high speeds. These bearings are suitable for portable tools, small motors, relays and other small apparatus.

The closed-type ball bearings are single-row annular bearings, supplied either with or without filling notches and with either brass or bronze retainers. They will carry an equal thrust load in either direction and may be applied to almost any bearing application.

"GreaSeal" felt-protected ball bearings are single-row annular bearings similar to the closed type, except there is a felt seal at one side for protection against the entrance of dirt and against the escape of grease lubricant. The felt is held between two steel snap washers attached to the outer ring and forms a labyrinth protection with the recessed inner ring. This bearing will also carry an equal thrust load in either direction.

The double-row of self-alining ball bearings have a spherical outer raceway to provide the self-alining feature. These bearings are for use where it is impossible to be assured that the bearings and parts are accurately lined up. They are equipped with extruded bronze retainers, completely machined and are designed to permit the use of the maximum number of balls on each row.

The angular-contact ball bearings are single-row annular bearings designed to carry heavy thrust loads in one direction



Closed-type ball bearing

in addition to radial loads. They are equipped with one-piece completely machined extruded bronze retainers carried on the ground flanges of the inner ring.

The standard type roller bearings are single-row cylindrical roller bearings having rollers of the same length as the diameter. They are capable of carrying heavy radial loads and will also sustain heavy temporary overloads and shocks. They are equipped with completely machined, well-balanced extruded bronze retainers carried on the ground flanges of the inner ring. These bearings, of course, will not carry a thrust load.

Landis Grinder—A Correction

In the February issue of the *Railway Mechanical Engineer*, page 80, appeared a description of the Landis tool and cutter grinder, the manufacturer of which was erroneously stated to be the Landis Machine Company, Waynesboro, Pa. This tool is manufactured by the Landis Tool Company, Waynesboro, Pa.

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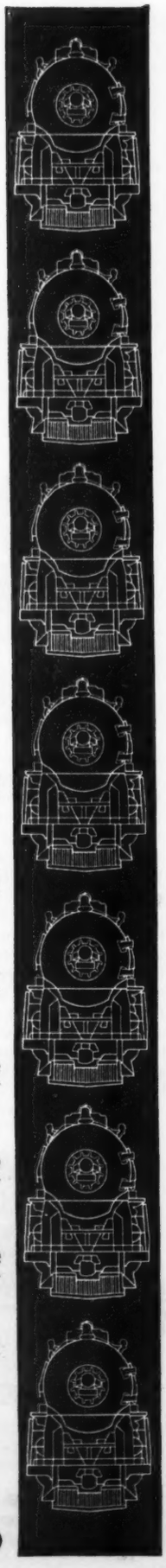
SUPER-POWER
is a principle



Super-Power Steam

Locomotives are generally regarded as the largest and most powerful that can be built « "Super-Power" means much more than this. It means getting the maximum work out of a pound of metal and a pound of steam « Locomotives embodying the principles of "Super-Power" can be built for light as well as heavy service and will perform so much more economically that you can't afford to run the old ones.

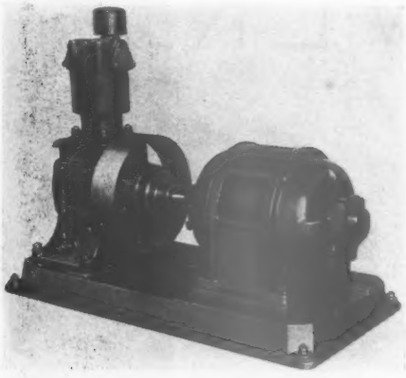
LIMA LOCOMOTIVE WORKS INCORPORATED

LIMA LOCOMOTIVE WORKS • Incorporated • LIMA • OHIO

Two Sullivan Air Compressors

The Sullivan Machinery Company, Chicago, has added a number of new designs to its line of vertical single-acting compressors, which are known as Models WL-1, WL-11, WL-2 and WL-4.

WL-1, which has belt or V-belt drive, and WL-11, which is directly driven by a motor, are single-cylinder single-acting units which provide piston displacements ranging from 27 to 87 cu. ft. of free air per minute and are designed for pressures up to 125 lb. per sq. in. These units are said to be distinguished by their compactness, simplicity and substantial construction. The crank shafts are mounted on

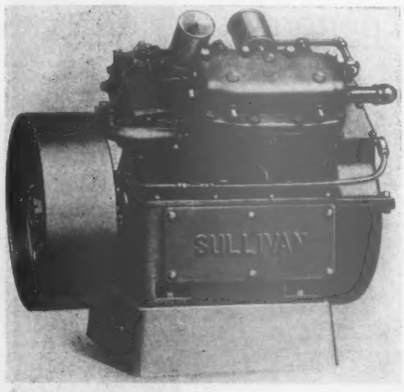


The WL-11 vertical direct-connected compressor

heavy-duty ball bearings, while the cylinders are cast separately and bolted to the frames, as a means of permitting economical reboring or replacement when necessary. The cylinder heads, which contain the inlet and discharge valves, may be attached in any one of four horizontal positions.

In those units that are directly connected to driving motors, flexible external and internal gear couplings are employed between the compressor flywheel and the motor shaft. The unloading system is of the Sullivan "sweep control" type, and automatic regulation of several types may be had, including manual, semi-automatic and automatic start and stop control for both units.

Models WL-2 and WL-4, which are belt-driven units, are available in two-cylinder and four-cylinder models, respectively, and are similar to directly connected units already available. These units may be driven also by V-belts from any desirable form of power unit, and in such cases the compressor, motor and V-belt drive are mounted on a sub-base. The capacities of these models range from 119 to 348 cu. ft. of free air per minute.

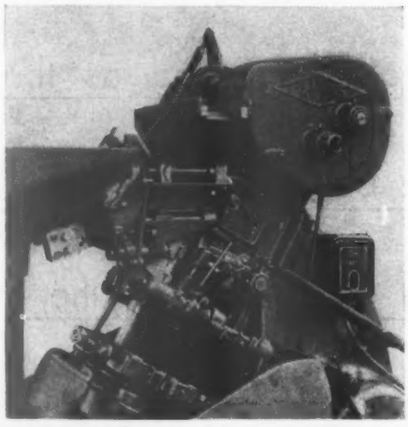


The WL-4 V-type belt-driven compressor

The four-cylinder units are of the V-type balanced design, the two pairs of cylinders being set at an angle of 90 deg. with a common crank shaft and two cranks. Such an arrangement contributes to compactness and is said to provide an important factor of balance. The use of four small cylinders instead of two large ones permits the use of reciprocating parts which are said to weigh only one-third as much as the same parts would weigh in a two-cylinder unit of equivalent capacity.

Landis Stud Attachment

The Landis Machine Company, Inc., Waynesboro, Pa., has developed a stud attachment for its ¾-in. automatic forming and threading machine which gives it a production rating of 200 to



The Landis stud attachment applied to an automatic forming and threading machine

500 per cent as a stud machine. This high rating is due to the fact that the loading (and unloading), pointing and threading operations are performed simultaneously at three seperate stations.

Another feature of the attachment is its ability to handle sheared blanks. This practice saves material, eliminates the more expensive cutting-off operations and reduces the manufacturing cost.

The attachment consists of a hopper and a magazine. An agitator located at the base of the hopper insures an orderly and uninterrupted flow of the blanks to the magazine. From the magazine the blanks are fed, one at a time, to a slot through which they drop into an auxiliary magazine. The auxiliary magazine is a sectoral chamber which positions the blanks for transfer to the loading station of the turret.

For the second operation, the semi-finished studs are stacked in the hopper with their blank ends at the front of the hopper. The front wall of the hopper is hinged and can be dropped to facilitate loading.

The pointing head takes care of any variations in the lengths of the blanks and insures studs of uniform length. It will also point blanks of uniform length with the minimum amount of waste.

The attachment is a self-contained unit which can be applied to machines in service. It is adjustable and will accommodate studs from ¼ in. to ¾ in. in diameter, from 1½ in. to 6 in. in length and a 2½ in. maximum thread length. The unthreaded section of the stud cannot be less than 75 per cent of the diameter. The attachment can be applied and set up in 30 min.

Aetna Bearing Oil Seal

The Aetna oil seal placed on the market by the Aetna Ball Bearing Manufacturing Company, Chicago, consists of only four parts and is a self-contained and complete unit which can be slipped in or out of position, with nothing to work loose or become lost. It consists of an outer shell of steel, accurately formed and ground on an outside diameter to a precision commensurate with that of anti-friction bearings. This shell houses the seal cushion, pressure plate and steel retainer.

The thermo-pneumatic seal cushion consists of specially treated cork in which the interstices or air cells are hermetically sealed. This pneumatic seal cushion automatically expands and contracts laterally with changing temperature of shaft or lubricant, remaining always oil tight in consequence. It is non-hygroscopic and impervious, is of great resiliency, has a low friction coefficient and is abrasive-resistant. The deflector pressure plate of dense, specially treated fibre deflects oil from the seal proper, serving to maintain a constant and steady pressure upon the

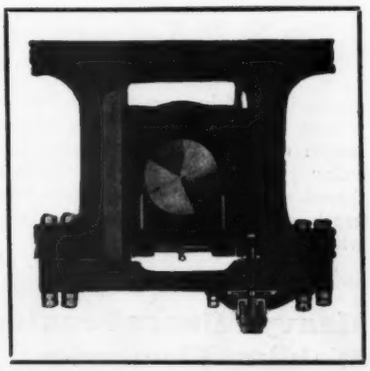
(Continued on next left-hand page)

Cross-sectional view of the Aetna oil seal showing the four component parts assembled

EVERY POUNDING WEDGE

Is Notice Of A Maintenance Job On The Way . . . .

Keep out the slack and you keep down repair costs. « But even though you set up ordinary driving box wedges as tightly as you dare, you must still leave a fraction of an inch for temperature rise when the engine is on the road. « This fraction of an inch grows under the shock of the piston thrust into the too familiar clank! « If you could only adjust the wedges as the locomotive runs, you could keep the slack from gaining a foothold. « Franklin Automatic Adjustable Wedges do just this. They adjust the wedges with every revolution of the drivers and reduce maintenance by preventing slack. « Every locomotive needs them. Every long run requires them.



FRANKLIN RAILWAY SUPPLY CO., INC.

NEW YORK CHICAGO MONTREAL

pneumatic cushion and a uniform pressure over the entire periphery of the seal while relieving it of extraneous internal pressure. In this way the pneumatic seal is always maintained concentric with the shaft and is relieved of longitudinal pressure—so overcoming one most common cause of leakage among other so-called grease seals.

At the present time where high-pressure lubricating systems are being used so widely, this duplex seal—with the tendency for the two major component parts to seal themselves closer together, the stiff, yet resilient deflector pressure plate taking the internal pressure, while the softer, pneumatic cushion is relieved of pressure, will, it is claimed, hold oil as well as grease and will operate without trouble where water is held on one side of the seal and oil on the other.

The seal is interchangeable with all makes of grease seals and is available in sizes from ½-in. inside diameter and up.

High Speed Rotary Air Grinder

The Independent Pneumatic Tool Company, 600 West Jackson Boulevard, Chicago, has added a high-speed rotary air grinder to its line of pneumatic tools. This size will be known as 255-X and is designed to operate cone-shaped grinding wheels.

This type of grinder is used by foundries and machine shops for cleaning castings of all descriptions, and for grinding castings and forgings where the use of the ordinary emery wheel is not practicable.

The speed of the Thor 225-X is 10,000 r.p.m. and it will operate cone wheels measuring 2¾ in. outside diameter. The weight of the machine is 8¾ lbs. The length overall is 19¼ in. The driving collar is provided with right-hand thread so that the cone wheels now in use in shops and foundries may be used with the grinder.

Thor No. 255-X rotary pneumatic grinder equipped with cone emery wheel

Heavy Mineral-coated Welding Electrodes

A new line of arc-welding electrodes, which have a heavy all-mineral flux coating, has been placed on the market by the Metal & Thermit Corporation, acting as exclusive sales agents for the American Murex Corporation, which is the manufacturer. Both companies have offices at 120 Broadway, New York.

The new electrodes, known as Murex, are made 18 in. long and in types and sizes suitable for a wide range of horizontal, vertical, and overhead welding operations.

A feature of the electrode is a patented spiral winding of asbestos yarn which serves to hold the heavy mineral flux to the core so that it is not injured if the electrode is bent. The manufacturer points out that the all-mineral ingredients of the flux on a Murex electrode causes it to burn without objectionable fumes or smoke, while the thickness of the coating enables the operator to ride the electrode on the work, thus letting the flux coating space the arc.

Among the eight types of electrodes in the Murex line there are electrodes for welding commercial mild steel, manganese steel, 18-8 stainless steel, and stainless iron.

Electrode for Welding Aluminum

The Lincoln Electric Company, Cleveland, Ohio, has announced a new electrode for welding aluminum which will be known as "Aluminweld." The new electrode is a 5 per cent silicon-aluminum alloy and can be used for welding sheet or cast aluminum. It is designed for either metallic or carbon arc welding.

It is provided with a coating which prevents excessive oxidation and will dissolve any aluminum oxide that might be formed. The manufacturers claim that the coating assists in giving a very smooth operating arc which is particularly essential in electric welding aluminum.

The resulting weld is very dense without porosity and possesses high tensile strength. The weld can also be polished satisfactorily with practically no discoloration, so it is claimed.

In its use a short arc of approximately 20 volts should be held with the coating practically in contact with the work. The current to be used will vary with the thickness of sheet or material to be welded but the following table gives a good idea of the proper electrodes and range of currents.

Size of electrode	Current range	Average
3/32 in.	35— 45 amp.	40 amp.
1/8 in.	55— 80 amp.	70 amp.
3/16 in.	100—150 amp.	125 amp.

The 3/32-in. electrode is used for sheets up to No. 14 gage; the ⅛-in. electrode from No. 14 gage to ⅛ in. and the 3/16-in. electrode, for sheets over ⅛ in. thickness. Sheets of over 3/16 in. thickness should have the edges beveled if welded from one side only. In all cases when used with the metallic arc process reversed polarity is used.

Aluminweld is produced in four sizes, 3/32 in., ⅛ in., 5/32 in. and 3/16 in. in 14-in. lengths.

Standard 4-Hp. Special Vertical Grinder

The vertical grinder illustrated was recently designed by The Standard Electrical Tool Company, Cincinnati, Ohio.

A special 4-hp. General Electric 3,600-r.p.m. motor is used and is operated by a General Electric switch mounted on the housing. SKF ball bearings are used, a special bearing being provided to take care of the end thrust. This machine is equipped with a cup wheel 7 in. in diameter with a 1¼-in. wall. The net weight is 155 lb.

A pad is provided on the vertical feed for attaching the grinder to a planer or other machine tool. This machine can also be furnished with both horizontal and vertical feeds. This type of machine is especially adapted for grinding dies, or for surface grinding on a planer or boring mill. It is made in sizes of 3-hp. up to and including 10 hp.

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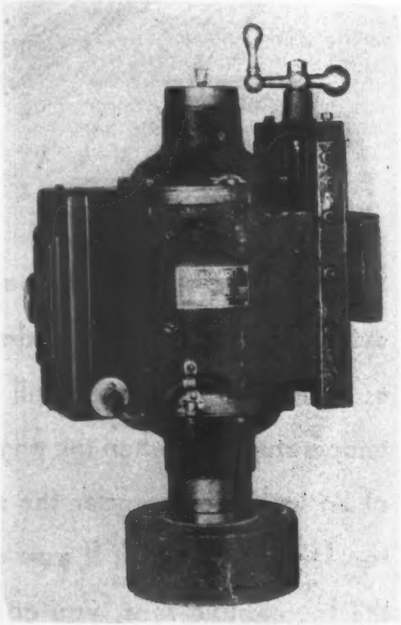

The Standard vertical grinder is designed for use on a planer or other machine tool

Train of 72 loaded refrigerator cars, weighing 3390 tons, climbing one per cent grade, handled by a 2-8-8-2 locomotive

One Modern High-Power Unit Replaces Two Locomotives

THE Western Pacific Railroad, whose main line extends from Salt Lake City, Utah, to San Francisco, California, a distance of 928 miles, handles a heavy east-bound tonnage of fresh fruits and vegetables, which must be moved on fast schedules. The most difficult portion of this run is through the Feather River Canyon, where, for a distance of over 100 miles, there is a practically continuous grade of one per cent.

On that section, freight is being handled by single expansion locomotives of the 2-8-8-2 type, built at our Works in 1931.

An average solid fruit train consists of 70 cars weighing 3300 tons, and with this tonnage one locomotive can maintain a speed of 18 to 20 miles an hour on the one per cent grade. Formerly, a train of this weight was handled by a 2-6-6-2 type Mallet compound, with a heavy Mikado as a helper. One of the new locomotives develops as much tractive force as the two locomotives formerly used.

These large locomotives are proving an unqualified success, and are demonstrating that—

It takes Modern Locomotives to make money these days!

THE BALDWIN LOCOMOTIVE WORKS
PHILADELPHIA

Among the Clubs and Associations

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—The proposed change in the A.R.A. Rules of Interchange for 1933 will be discussed by the members of the Car Foremen's Association of Chicago at their meeting at 8 p.m. on March 14 at the Auditorium Hotel, Chicago.

NORTHWEST CAR MEN'S ASSOCIATION.—Recommended changes in A.R.A. Interchange Rules will be discussed at the meeting of the Northwest Car Men's Association which will be held at 8 p.m. on March 21 at the Minnesota Transfer Y. M. C. A. Gymnasium building, St. Paul, Minn.

CANADIAN RAILWAY CLUB.—At the March 14 meeting of the Canadian Railway Club which will be held at 8 p.m. at the Windsor Hotel, Montreal, W. Pratt, general manager sleeping and dining car and hotel department, Canadian National, will present a paper on Sleeping and Dining Car Service.

MECHANICAL DIVISION ANNUAL MEETING.—According to circular No. D. V.-758, issued by the American Railway Association, Mechanical division, over the signature of Secretary V. R. Hawthorne, the thirteenth annual meeting of this division will be held at Chicago on Thursday and Friday, June 23 and 24. The sessions of the convention will be held in the Louis XVI room of the Congress hotel, which will also be convention headquarters.

NEW YORK RAILROAD CLUB.—The March 18 meeting of the New York Railroad Club, which will be held at 8 p.m. at the Engineering Societies building, 29 West Thirty-Ninth street, New York, will be Electrical Night under the auspices of the Westinghouse Electric & Manufacturing Company. The subject for discussion will be the Pennsylvania's new electrification, and a stage field demonstration in the field of new electrical invention and discovery will be presented.

FORGING MANUFACTURERS' ASSOCIATION.—At the annual meeting of the Forging Manufacturers Association, held at the Engineers Club, New York, on January 15, the following officers were elected for the year 1932: President, C. W. Heppenstall, Heppenstall Company, Pittsburgh, Pa.; Vice-president, R. F. Devine, Jr., Erie Forge Company, Erie, Pa.; Vice-president, C. E. Wilder, National Forge & Ordnance Company, Irvine, Pa.; and Treasurer, C. E. Finkl, A. Finkl & Sons Company, Chicago.

WESTERN RAILWAY CLUB.—As announced in last month's issue, the February 15 meeting of the Western Railway Club, known as Family Night, was planned to provide an interesting program not only for railway and supply members but for their families as well. The total attendance was about 300. Dr. Phillips Thomas, research engineer of the Westinghouse Electric & Manufacturing Company, presented a highly-interesting and non-technical discussion of the subject "Electricity at Work and at Play."

Club Papers

Lubrication Conference

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Meeting held Friday afternoon, February 19, Engineering Societies building, 29 West Thirty-Ninth street, New York. Subject, Railroad Lubrication. ¶The Railroad Division and the Sub-Committee on Lubrication Engineering of the Petroleum Division, American Society of Mechanical Engineers, sponsored an informal conference on the general subject of Railroad Lubrication. Eliot Sumner, assistant to general superintendent motive power, Pennsylvania, Philadelphia, Pa., and a past chairman of the Railroad Division, presided. The discussion was based largely on a paper presented by C. M. Larson, supervisory engineer, Sinclair Refining Company, New York, who discussed the problem from the viewpoint of the lubrication engineer. H. E. Brunner, chief engineer, SKF Industries, New York, discussed the problem from the standpoint of the design of car and locomotive roller bearings. The discussion of that portion of the general subject on railroad operation was led by C. E. Barba, mechanical engineer, Boston & Maine, North Billerica, Mass. Mr. Barba's remarks were somewhat in the nature of a rebuttal of the points brought up by Mr. Larson. T. V. Buckwalter, vice-president, Timken Roller Bearing Company, Canton, Ohio, presented additional data and information on the subject of roller-bearing lubrication in connection with Mr. Brunner's discussion. ¶William F. Parrish, consulting lubrication engineer, New York, proposed a resolution that Mr. Sumner, in co-operation with the Lubrication Engineering Committee and the railroad Division Executive Committee, prepare a plan of investigation and research of railroad lubrication which can receive the co-operation of all interested groups and associations; and that this plan be submitted to a future conference subject to the call of these two committees. The resolution was adopted. A more complete report of this informal conference will appear in an early issue of the *Railway Mechanical Engineer*.

Transportation of Frozen Foods

NEW ENGLAND RAILROAD CLUB.—Meeting held Tuesday evening, January 12, Copley-Plaza Hotel, Boston. Subject, "Quick Freezing and Its Bearing on Transportation of Frosted Foods," presented by Clarence Birdseye, director of the Birdseye Laboratories, Gloucester, Mass. ¶Mr. Birdseye described the development of a new industry in the field of perishable foodstuffs; that is, the preparation, transportation and distribution of products which have been subjected to quick freezing and which must be maintained in the frozen state until they reach the consumer. He described the effect of slow freezing on animal and vegetable tissues as a separation of fresh water ice crystals which grow in size sufficient to rupture some of the cells while they compress and dehydrate others, a process which concentrates the dissolved substances, and which is not reversible on thawing. These processes, he said, are more pronounced and less reversible in plant tissues than in animal flesh. The quick freezing process removes the heat so rapidly that the separation and growth of fresh water ice crystals does not take place to a sufficient extent to destroy the natural freshness of the products. ¶Mr. Birdseye described the development in producing and marketing frozen products effected by his company since March, 1930. Last year 214 different stores distributing frozen products were established in New England. "Our production program for 1932," he said, "calls for an increase of approximately 1,000 per cent in our production for 1931. That means probably twenty million units of fruits, vegetables, sea foods, meats and poultry that we shall protect in 1932, a year and a half after the effort was first commercialized." ¶Mr. Birdseye described the transportation requirements of various frozen products, some of which can be distributed in corrugated fibre-board containers, properly lined, by ordinary express or parcels post, the products themselves retaining sufficient refrigeration for transcontinental shipment. Most quick-frozen perishables, however, call for shipment in carload lots. For animal tissues it is not difficult to prevent deterioration with temperatures at about 20 deg. F. But in the case of plant products, he said, if the vegetables and fruits are to be in transit for a week or longer temperatures should not be higher than 10 deg. F. This requires more than the customary amount of insulation in refrigerator cars cooled with ice and salt. ¶The discussion indicated a lively interest in the implications of this new industry with respect to the transportation problems which will have to be met as its development spreads.

Conditions in China

NEW YORK RAILROAD CLUB.—Meeting held Friday evening, February 19, at the Engineering Societies building, New York. Subject, "The Actual Railway and General Economic Situation in China," presented by John J. Mantell, recently railway advisor to the Chinese government. ¶Mr. Mantell pointed out that the development of China's agricultural and mineral resources depends largely on the reorganization and rehabilitation of the country's railroads. The Chinese railways, he said, are developed along the continental plan, involving short hauls, light loads and small trains, whereas the real development of the country requires railway organization based on long hauls, heavy loads and long trains, as well as a rate structure that would favor development of the country as a whole, as against the present slow isolated development of different sections of the country. ¶"My report," said Mr. Mantell, "emphasized the immense possibilities to the country in the reorganization of the railways of China, and the construction of additional railways, but I pointed out also that the existing railways, with their antiquated and continental methods would have to be thoroughly modernized. To this end I suggested to the government that a corps of American engineers should be asked to take over the railways for the Chinese Government and operate them for a period of five to seven years, in order properly to educate the technically trained Chinese railway men in modern railway practice." ¶Mr. Mantell spent considerable time in Manchuria in connection with his railway investigations. While he was in Mukden, he said there was evidence of general unrest and frequent indications of hostilities between the Chinese and Japanese. He pointed out that Japan has spent a large sum of money developing the South Manchurian Railway and the coal mines outside of Mukden. He recommended, however, that the Chinese government should see to it that the rich, agricultural and mineral resources which China owns in Manchuria should be released from the present strangle-hold of railway restrictions to which traffic is now subjected.

Air Brakes

MANHATTAN AIR BRAKE CLUB.—Meeting held Friday afternoon, February 19, at 150 Broadway, New York. ¶The members of the Manhattan Air Brake Club discussed eight topics at the February meeting. These topics were as follows: Automatic Slack Adjusters; Wheel Failures on Gas-Electric Rail Cars; Cleaning and Lubricating Triple Valves; Is It Necessary to Have a Leakage Groove in the Brake Cylinders Used in Passenger- and Freight-Train Service?; Brake Shoes; Locomotive Brake Cylinders, and Would it be Advisable to Change the Pipe Connection so that the Equalizer-Reservoir Pressure Would be Indicated on the Black Hand of the Small Gage and the Brake-Pipe Pressure on the Black Hand of the Large Gage? ¶In discussing automatic slack adjusters, the question was asked relative to wear and frequency of renewals. It was pointed out that periodic cleaning and lubrication and careful resetting when new brake shoes are applied to the car would reduce wear and tear to the slack adjuster. ¶One railroad in the east reported some trouble with thermal cracks in the wheels of its gas-electric rail cars. It was pointed out that in all probability these cracks were caused by overheating of the wheels because of the frequency of stops from relatively high speeds. Overheating of the wheels due to braking was undoubtedly aggravated somewhat on account of the relatively steep grades and numerous curves existing on most branch lines. ¶The subject of cleaning and lubricating of triple valves was held over until the March meeting when a paper prepared by Mark Purcell, general air brake inspector, Northern Pacific, will be read.

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

ALLIED RAILWAY SUPPLY ASSOCIATION.—F. W. Venton, Crane Company, Chicago.

AMERICAN RAILWAY ASSOCIATION.—DIVISION V.—MECHANICAL.—V. R. Hawthorne, 59 East Van Buren street, Chicago.

DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey street, New York.

DIVISION I. — SAFETY SECTION. — J. C. Caviston, 30 Vesey street, New York.

DIVISION VIII.—CAR SERVICE DIVISION.—C. A. Buch, Seventeenth and H. streets, Washington, D. C.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.

RAILROAD DIVISION.—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York.

MACHINE SHOP PRACTICE DIVISION. — Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.

MATERIALS HANDLING DIVISION.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.

OIL AND GAS POWER DIVISION.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.

FUELS DIVISION.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa.

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

CANADIAN RAILWAY CLUB.—C. R. Crook, 2276 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month except in June, July and August at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT OFFICERS ASSOCIATION.—A. S Sternberg, master car builder, Belt Railway of Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 2514 West Fifty-Fifth street, Chicago. Regular meetings, second Monday in each month except June, July and August, Auditorium Hotel, Chicago, Ill.

CAR FOREMEN'S ASSOCIATION OF OMAHA, Council Bluffs and South Omaha Interchange.—Geo. Kriegler, car foreman, Chicago, Burlington & Quincy, Sixteenth avenue and Sixth streets, Council Bluffs, Iowa. Regular meetings, second Thursday of each month at Council Bluffs.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—Jos. F. Brady, 4036 Scanlon Place, St. Louis, Mo. Regular meeting first Tuesday in each month, except July and August, at American Hotel Annex, St. Louis, Mo.

CENTRAL RAILWAY CLUB OF BUFFALO.—T. J. O'Donnell, executive secretary, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meeting, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

CINCINNATI RAILWAY CLUB.—D. R. Boyd, 2920 Utopia Place, Hyde Park, Cincinnati, Regular meeting, second Tuesday, February, May, September and November.

CLEVELAND RAILWAY CLUB.—F. B. Frericks, 14416 Alder avenue, Cleveland, Ohio. Meeting second Monday each month, except June, July and August, at the Auditorium, Brotherhood of Railroad Trainmen's building, West Ninth and Superior avenue, Cleveland.

EASTERN CAR FOREMEN'S ASSOCIATION.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings fourth Friday of each month, except June, July, August and September.

INDIANAPOLIS CAR INSPECTION ASSOCIATION.—P. M. Pursian, 823 Big Four building, Indianapolis, Ind. Regular meetings first Monday of each month at Hotel Severin, Indianapolis, at 7 p.m. Noon-day luncheon 12:15 p.m. for Executive Committee and men interested in the car department.

INTERNATIONAL RAILROAD MASTER BLACKSMITH'S ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash street, Winona, Minn.

MASTER BOILERMAKERS' ASSOCIATION. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

MASTER CAR BUILDERS' AND SUPERVISORS' ASSOCIATION.—See Car Department Officers Association.

NATIONAL SAFETY COUNCIL—STEAM RAILROAD SECTION.—W. A. Booth, Canadian National, Montreal, Que. William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting, second Tuesday in each month, excepting June, July, August and September. Copley-Plaza Hotel, Boston.

NEW YORK RAILROAD CLUB.—A. N. Dugan, National Bearing Metals Corporation, 230 Park avenue, New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York.

NORTHWEST CAR MEN'S ASSOCIATION.—E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meeting third Monday each month, except June, July, and August, at Minnesota Transfer Y. M. C. A. Gymnasium building, St. Paul.

PACIFIC RAILWAY CLUB.—W. S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

RAILWAY BUSINESS ASSOCIATION. — Frank W. Noxon, 1124 Woodward building, Washington, D. C.

RAILWAY CAR MEN'S CLUB OF PEORIA AND PEKIN.—C. L. Roberts, R. F. D. 5, Peoria, Ill.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August, Ft. Pitt Hotel, Pittsburgh, Pa.

RAILWAY FIRE PROTECTION ASSOCIATION.—R. R. Hackett. Baltimore & Ohio, Baltimore, Md.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, July, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

SUPPLY MEN'S ASSOCIATION. — E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division American Railway Association.

TORONTO RAILWAY CLUB.—J. A. Murphy, Box 8, Terminal "A," Toronto, Ont. Meetings third Monday of each month, except June, July and August.

TRAVELING ENGINEERS' ASSOCIATION. — W. O. Thompson, 1177 East Ninety-eight street, Cleveland, Ohio.

WESTERN RAILWAY CLUB.—J. H. Nash, 343 South Dearborn street, Chicago. Regular meetings, third Monday in each month.

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ALCO
LOCOMOTIVE FORGINGS

ON THE T
LOCO

QUALITY ALL WAYS
QUALITY ALWAYS

THE splendid performance of the Timken Locomotive on its first 100,000 miles, clearly justified the Timken management in their courageous investment and confirmed their judgment in the selection of Alco as its builder, and the specialties used in its construction. Naturally, only the highest quality products were selected to insure the best all around locomotive performance which would demonstrate to greatest advantage the economies of Timken roller-bearings.

Alco axles, side rods, crank pins, and piston rods were specified because for years they have proved their great strength and capability for reliable and enduring service. Alco Forgings are precision built, not only precise in every dimension, but precise in every phase of manufacture. Complete physical, chemical and microscopical equipment insures the closest control over the quality of Alco Forgings from billet to finished forging.

The extensive equipment necessary for this high quality represents an investment in plant facilities and years of research, far beyond the economical duplication in any railroad shop.

That is why we say it is much cheaper for a railroad to buy Alco Forgings than to equip, maintain and operate shops to manufacture them.

E TIMKEN
COMOTIVE

Alco
REVERSE GEAR

EFFICIENT IN OPERATION
ECONOMICAL IN MAINTENANCE

AND when it came to the reverse gear—Timken chose the Alco. And why not? Thousands of Alco Power Reverse Gears are operating satisfactorily on modern locomotives throughout the country on different roads and without a complaint.

The Alco Power Reverse Gear is powerful—yet simple and easy to operate. A short stroke of the arm gives complete reverse almost instantaneously.

It is economical in operation and maintenance. It is interchangeable—it fully meets all the conditions imposed on freight, passenger and switching locomotives. With only one type of gear on all locomotives, only one type gear parts need be kept in stock.

The Alco Gear is reasonably priced—and last but not least—the engineers like it.

American Locomotive Company
30 Church Street New York N.Y.

NEWS

Domestic Orders Reported During February, 1932

Name of Company	Freight Cars No. Ordered	Type	Builder
Thunder Bay Quarries Company	4	Air-dump	Koppel Industrial Car & Equipment Co.
Hauser Construction Company	2	Air-dump	Magor Car Corporation
Norfolk & Western	4	Tank	Company Shops
Total for month	10		

Curtains in Refrigerator Cars

THE MISSOURI-KANSAS-TEXAS, by placing a curtain across a refrigerator car so as to divide the car into two parts, has made it possible for such a car to render service for which two cars were previously required. Perishable and non-perishable freight may thus be carried in the same car.

Under the new arrangement 29 of these special cars are loaded and forwarded weekly from Kansas City to various points on M-K-T lines. Each is equipped with a patented standard-size dividing curtain, which can be easily and quickly installed in any refrigerator car, preferably near the door, partitioning one end for the loading of perishable shipments.

The curtains are attached to the ceiling and side walls with double-headed nails which can easily be removed at destination without injury to the insulation. In the center of each curtain is a fastening device which can be easily and speedily adjusted. When removed at destination, the curtains are compactly wrapped and tied and returned to the point of origin.

The cost of the initial icing and the re-icing of one car is only one-half the former cost. It is estimated that discontinuing the operation of approximately 80 non-iced merchandise cars has reduced by 20,000 the car-miles per month.

Walker's Window Clarifier

THE LONG ISLAND road is trying a new arrangement for wiping frost or snow off the front windows of locomotives, the invention of James B. Walker, New York City, secretary of the Metropolitan division of the New York State Public Service Commission. Mr. Walker has had the device patented.

The invention consists of two window panes of equal size, moving up and down in a vertical frame, each sash being connected with a chain which runs over pulleys at the top of the frame. When one sash is lowered the other automatically rises to the observation position. At the bottom there is a pocket to receive the sash, and in the pocket there is an electric heater, providing sufficient heat to melt quickly any snow which may have accumulated. The pocket also contains two sets of rubber window wipers. When the engineman lowers the snow-covered window into the pocket its place is immediately taken by the clear pane. In a hard snowstorm the window can be reversed every minute, or as often as necessary. Operation of the windows is by hand, but it would, of course, be a simple matter to install an air or electric motor.

Activity Results from Wage Cut

THAT THE ACCEPTANCE by railroad employees of a 10 per cent reduction in wages will stimulate business is reflected in the reaction that is already taking place and by the manner in which several railroads have stated publicly that they will utilize the amount saved as a result of the reduction. On February 2 the Chicago & North Western announced that 500 men will be put to work in its locomotive shops at Chicago. Fred W. Sargent, president of the North Western, estimates that the 10 per cent wage reduction will save the road around $6,000,000 annually. While the carrier will report a substantial deficit after charges for 1931, Mr. Sargent believes prospects for 1932 are sufficiently bright to warrant spending a portion of the saving on maintenance of equipment. With revenues improved, it is believed shops at other points on the system will be reopened.

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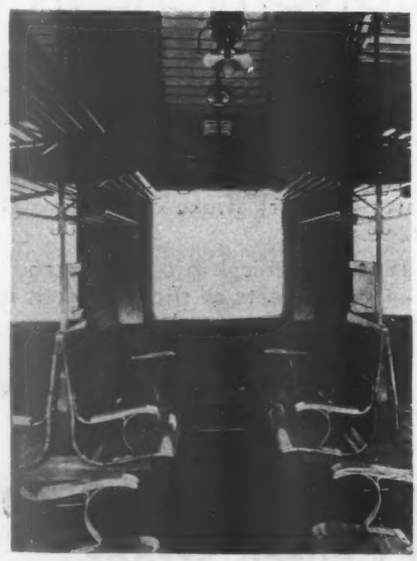

A third-class compartment on the Swiss Federal Railroads

P. H. Joyce, president of the Chicago Great Western, states that the financial condition of that road is such as to permit the expenditure of the entire $500,000 saved by the wage reduction for maintenance work. The road is entering 1932, Mr. Joyce said, in good condition physically and with no need for heavy outlay of funds for improvement of the property. Maintenance schedules this year will be directed largely to keeping the road up to its average standard.

The Union Pacific, which will save about $6,000,000 in wages, will also use a large part of this amount in carrying out its maintenance program.

James E. Gorman, president of the Chicago, Rock Island & Pacific, in commenting upon the effect of the $215,000,000 wage reduction in stimulating business, said: "There will be a lot of money spent. Anyone can run a better railroad with funds to purchase adequate equipment than he could otherwise. More should be spent for maintenance and in other directions. There is not much likelihood of new car buying, as the reduction in traffic has left the roads with more cars than they need. In other directions, however, there should be improvement."

Some sources estimate that 100,000 men will be put back to work in the shops and the maintenance of way departments during the year. H. E. Newcomet, vice-president of the Pennsylvania, believes that increases in expenditures by railroads will be gradual. "I think," he said, "it will be two or three months before the railroads start doing much in the way of opening shops, purchasing equipment and increasing outlay for maintenance of property. I believe railroad managements will wait until conditions are adjusted and business more stabilized." The Pennsylvania also plans to borrow $5,000,000 a month from the Reconstruction Finance Corporation to continue electrification work in the east and employ about 20,000 additional men. "Every penny requested from the finance corporation will be utilized for the purpose of giving employment and ordering materials from the various industries," Gen. W. W. Atterbury, president, said.

The Atchison, Topeka & Santa Fe states that the company will probably expend between $12,000,000 and $13,000,000 during the year for capital expenditures, such as additions, betterments and improvements. In addition the road expects to continue the construction of the new line from Boise City, Okla., to Las Animas, Colo., providing a new short route from the Texas Panhandle to the Colorado gateway.

Paul Shoup, president of the Southern Pacific, has announced that his road will place orders for 20,000 tons of rails and also will go into the market for a substantial order for ties, which should aid in reviving the lumber industry in that section of the country.

The settlement of the Canadian railroad wage dispute, under which employees of the Dominion lines agreed to accept a pay cut similar to that of the unions in this

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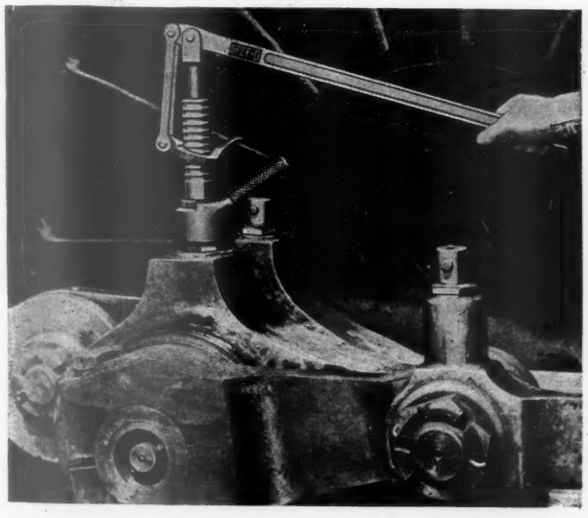
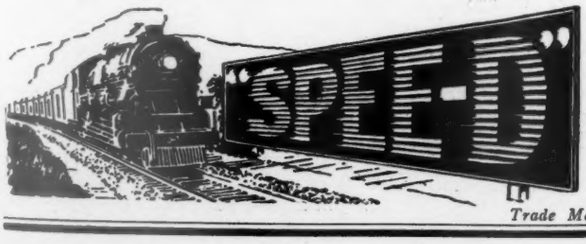
On the New Super Power *for the* Lehigh Valley



This new "SPEE-D" High Pressure Grease Gun can be used either vertically or horizontally with equal efficiency. Attachment to bearing and filling of rod cup usually requires less than thirty seconds.



TWENTY of the finest modern locomotives ever constructed is the LEHIGH VALLEY'S answer to the present demand for increased speeds in freight service.

Fast schedules, long runs and intensive operation demand efficient rod bearing lubrication. The "SPEE-D" High Pressure method was specified for all of the main rods, side rods and tender booster rods on these locomotives.

The high efficiency of "SPEE-D" lubrication insures freedom from those expensive rod bearing failures, greater mileage from crank pins, rod brasses and lubrication, and lower maintenance costs.

The savings in engine preparation costs usually refund the investment inside of a year.

RELIANCE MACHINE & STAMPING WORKS, Inc.
NEW ORLEANS, LA.

Agents and Representatives

H. C. MANCHESTER, 3712 Grand Central Terminal, New York City
Consolidated Equipment Company, Montreal
Mumford Medland, Ltd., Winnipeg
International Railway Supply Company, 30 Church St., New York City

Saves Time, Labor, Grease and Grease Plugs

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country, is expected to have a stimulating influence on trade and employment in that country. The Canadian rail unions agreed to accept a 10 per cent wage cut from December 1, 1931, until January 31, 1933.

The Beech Grove locomotive shops of the Cleveland, Cincinnati, Chicago & St. Louis at Indianapolis, Ind., resumed operations on February 15 with a force of 1,200 men, while the car repair and building shops are expected to resume operations soon. On February 15 the Collinwood locomotive shop of the New York Central at Cleveland, Ohio, recalled 1,100 men to work on repairs.

Examiner Recommends Requirement of Power Reverse Gear

EXAMINER John L. Rogers of the Interstate Commerce Commission has submitted to the commission a proposed report on the complaint filed by the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen and Enginemen recommending that the commission find that the safety of employees and travelers on railroads requires that steam locomotives used in road service having a weight in working order of 150,090 lb. or more on driving wheels, and locomotives used in yard service having a weight in working order of 130,000 lb. or more on driving wheels be equipped with power reverse gear.

While the defendant railroads had urged that the carriers generally are in such financial condition that they should not be required to comply with such a requirement, Examiner Rogers argued that since the recommendation is that the locomotives be equipped when they are shopped for Class 3 or heavier repairs and as a large proportion are out of service now, the expense will be distributed over a period of approximately four years. Clearly, he said, the carriers would not have equipped over 28,000 locomotives with power reverse gear and would not contemplate so equipping practically all new locomotives if such gears did not contribute to efficiency of operation or if power reverse gear is less safe than the hand reverse gear.

In his report, Examiner Rogers estimates that of the 60,522 locomotives which are subject to the jurisdiction of the Interstate Commerce Commission under the Boiler Inspection Act, as amended, 28,925 are equipped with power reverse gears and 31,597 are equipped with hand reverse gears. 'The record shows," he states, "that during the five-year period from 1925 to 1929, inclusive, there were 1,116 casualties due to reverse gear. The proportion of such casualties occurring on locomotives equipped with power reverse gear is illustrated by the fact that of 233 cases occurring in 1929 and 1930, a total of 217 occurred on locomotives equipped with hand reverse gear and 16 on locomotives equipped with power gears."

By adopting the recommendation that the application of reverse gear be limited to locomotives with the weights on drivers specified, the commissioner points out that it will be unnecessary to apply power reverse gears on approximately 14,000 locomotives now in use.

Supply Trade Notes

EDWIN S. WOODS & Co., have moved their office to 4710 West Division street, Chicago.

CHARLES N. STODDARD, vice-president of the Greenfield Tap & Die Corp., Greenfield, Mass., has been elected president and general manager, to succeed Francis G. Echols, retired.

A. E. BALLIN, formerly president of the McIntosh & Seymour Corporation, has been elected vice-president in charge of sales and engineering of the Nordberg Manufacturing Company, Milwaukee, Wis.

S. P. GOODLOE, Mutual building, Richmond, Va., has been appointed southeastern sales agent of the Globe Steel Tubes Company. Mr. Goodloe is under the jurisdiction of the New York office.

THE MANAGEMENT of the St. Louis plant of Joseph T. Ryerson & Son, Inc., has been taken over by Harold B. Ressler, vice-president at Chicago. Mr. Ressler, who was formerly the St. Louis plant manager for 15 years, will be in direct contact with the St. Louis organization, making regular visits to the plant and St. Louis territory. In Mr. Ressler's absence, R. B. Wilson, manager of sales of the St. Louis plant, will be the senior resident executive. Mr. Wilson, formerly of the Chicago service department, has been associated with the St. Louis organization for over 17 years.

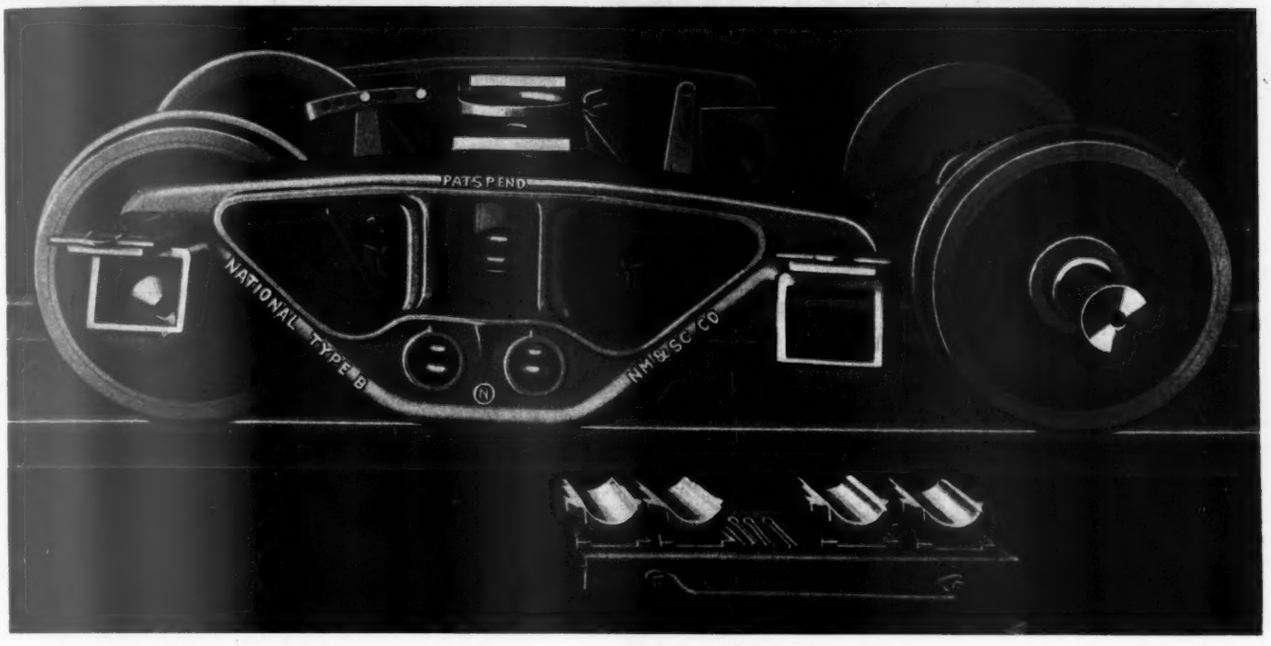
FRANK JAY, bus representative in New England territory of the American Car & Foundry Motors Company, has been elected vice-president, with headquarters at Detroit, Mich., succeeding W. L. Stancliffe, resigned. Mr. Jay will immediately assume direction of the automotive sales of the organization. William H. Woodin, president of the American Car & Foundry Company, has assumed C. S. Sale's duties as president of the American Car & Foundry Motors Company. H. W. Wolff, for many years vice-president in charge of sales of the American Car & Foundry Company, has taken over supervision of sales of the Motors Company; F. A. Stevenson, vice-president in charge of operation of the American Car & Foundry Company, has also assumed charge of manufacturing for the Motors Company and has effected closer co-operation between the American Car & Foundry Company, the J. G. Brill Company, the Hall-Scott Motor Car Company and the American Car & Foundry Motors Company. G. R. Scanland, vice-president in charge of finance of the American Car & Foundry Company, will take direct charge of finance of the Motors Company. President Woodin, in announcing the above, said that business conditions made it necessary to secure better results with less expense and to accomplish this purpose the American Car & Foundry Company has co-ordinated the Motors Company activities with those of the parent company.

WILLIAM F. DRYSDALE has been appointed vice-president in charge of sales and H. C. Butler has been appointed vice-president in charge of manufacturing of the Montreal Locomotive Works, Ltd., Montreal, and all of its subsidiaries. The company will manufacture and sell self-propelled rail units in accordance with the engineering and specifications of the J. G. Brill Company, Philadelphia, Pa.; a complete line of process plants and equipment for the oil-refining industry, using the patents and processes controlled by Alco Products, Inc., New York; a complete line of modern Diesel engines in accordance with the designs and patents of the McIntosh & Seymour Corporation, Auburn, N. Y., and will continue to manufacture and sell steam, electric and Diesel locomotives as heretofore. Mr. Butler was formerly manager of the Montreal Locomotive Works at Montreal. Mr. Drysdale was born on July 16, 1881, at St. Andrews, Argenteuil, Quebec. He was educated in the Montreal high school and McGill University, receiving from the latter a B. S. degree in 1904. During part of this time, from 1899 to 1904, he was also a special apprentice on the Grand Trunk. In 1904 he entered the employ of the American Locomotive Company as a draftsman, subsequently serving as calculator and cost estimator until 1906 when he was appointed assistant to chief engineer in charge of machine-tool, power and shop-engineering problems. He resigned in 1911 to become mechanical engineer of the North Railroad of Costa Rica and the Ferrocaril de Costa Rica, Central America, remaining in that work, also as superintendent of buildings for the United Fruit Company in Costa Rica, until 1914, when he was appointed assistant works manager of the Steel Company of Canada, in charge of shrapnel and high explosive shell work in the Montreal plants. He served in 1915 as special representative in Europe for the

William F. Drysdale

(Continued on next left-hand page)

TRUCKS ››› that Speed Train Operation



QUICK WHEEL CHANGE SAVES TIME AND MONEY

M17
National Draft Gear
Another contribution by National to profitable freight operation. This gear stands first in the combination of capacity, sturdiness and endurance.

NATIONAL Type B trucks are designed so that wheel changes can be made quickly at a saving in both time and cost. ›› On removal of the journal bearings, wedges and the brake hanger fastenings, side frames are spread apart, old wheels are rolled out and new ones rolled in. ›› No other parts are disturbed. ›› This is only one of a large number of important advantages of National Type B trucks, all secured without any premium in cost.

Details gladly furnished on request.

NATIONAL MALLEABLE AND STEEL CASTINGS CO.
General Offices: CLEVELAND, OHIO

Sales Offices: New York, Philadelphia, Washington, Chicago, St. Louis, San Francisco
Works: Cleveland, Chicago, Indianapolis, Sharon, Pa., Melrose Park, Ill.

NATIONAL
TYPE (N M&SC) ·· B ··
TRUCKS

Montreal Locomotive Works, Ltd., and the American Locomotive Company. In 1919 he was appointed managing director of the Worthington Pump & Machinery Company's interests in Belgium, France, Italy, Switzerland, Spain and Portugal. Five years later he was one of the organizers of the Brazilian Portland Cement Company, the first large Portland cement plant in the State of Sao Paola, Brazil. Mr. Drysdale is president of the Aerocrete Corporation of Canada and a member of a number of Canadian engineering societies.

A. E. BIDDLE, executive vice-president of the Universal Draft Gear Attachment Company, has been elected president, succeeding C. J. Nash, who has resigned, but who remains as a director.

THE WATSON-STILLMAN COMPANY, Roselle, N. J., has obtained the American rights to the Henley straight through lead sheathing presses and has entered into an agreement with Davy Brothers, Sheffield, Eng., covering the manufacture of Watson-Stillman equipment in England and the manufacture in the United States of certain of Davy Brothers' hydraulic equipment.

THE MODINE MANUFACTURING COMPANY, Racine, Wis., manufacturers of condensing, heating, cooling and ventilating equipment, has acquired the Melcher Company, originators of the multiple unit system for air-conditioning of railway cars. L. W. Melcher, president of the Melcher Company, will head a new railway division in the Modine organization, to which he brings the complete sales engineering personnel of the Melcher Company. The Modine Melcher multiple unit system of air-conditioning is now manufactured at the Modine plant at Racine. The railway sales division of Modine Manufacturing Company has headquarters at 333 N. Michigan avenue, Chicago.

Obituary

BENJAMIN B. GREER, who resigned in October, 1931, from the presidency of the New York Air Brake Company, died on February 28 at New Canaan, Conn.

JOHN WALTON ENSIGN, district manager in charge of the Huntington, W. Va., plant of the American Car & Foundry Company, died on February 18 at his home in Huntington after a brief illness, at the age of 61. Mr. Ensign began work at the age of 14 with his father who was managing executive of the Ensign Manufacturing Company, and later represented this company in Honolulu; this was one of the original companies included in the formation of the American Car & Foundry Company in 1899. Mr. Ensign, subsequently served in the general offices of the American Car & Foundry Company at St. Louis, Mo., and later succeeded his father as district manager at Huntington, which position he held at the time of his death. Mr. Ensign had taken an active part in civic affairs, having served as mayor of Huntington.

Personal Mention

General

P. M. SULLIVAN, master mechanic of the Duluth, Missabe & Northern, has been appointed acting superintendent of motive power and cars, with headquarters as before at Proctor, Minn.

Master Mechanics and Road Foremen

M. R. BROCKMAN, master mechanic of the Southern at Macon, Ga., has been transferred to Princeton, Ind.

H. G. STUBBS, master mechanic of the Southern at Princeton, Ind., has been transferred to Ludlow, Ky., to succeed J. A. Wilking, deceased.

H. B. NABORS, general foreman of the Southern, Lines West at Princeton, Ind. has been promoted to the position of master mechanic, with headquarters at Macon, Ga.

H. L. NEEDHAM, general master mechanic of the Northern lines of the Illinois Central, with headquarters at Chicago, has been appointed master mechanic, with headquarters at the same point, to succeed F. P. Nash, who has been transferred to Clinton, Ill., to fill a position that has been vacant for some time. The position of general master mechanic at Chicago has been abolished.

Purchasing and Stores

J. S. PARK, district storekeeper of the Canadian National at Saskatoon, Sask., has been transferred to Edmonton, Alta.

C. S. ARGYLE, district storekeeper of the Canadian National at Edmonton, Alta., has been transferred to Winnipeg, Man., to succeed Mr. Keillor.

E. A. RUSSELL, storekeeper of the Canadian National at Transcona, Man., has been promoted to the position of district storekeeper at Saskatoon, Sask.

S. E. Keillor, district storekeeper on the Canadian National, with headquarters at Winnipeg, Man., has been promoted to assistant general storekeeper of the Central region, with headquarters at Toronto, Ont.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

ELECTRIC TRUCKS.—Over 60 photographs of handling jobs in many lines of industry shown in the booklet issued by the Elwell-Parker Electric Company, Cleveland, Ohio, describe the various applications of electric trucks as designed for special handling jobs.

FORM TURNING MACHINES.—A 28-page catalog descriptive of the new Monarch-Keller form turning machine—a combination of the Monarch helical geared Timkenized lathe and the Keller automatic electric controls—has been issued by the Monarch Machine Tool Company, Sidney, Ohio.

CENTRIFUGAL PUMPS.—The Class LS single stage centrifugal pump and the Class OMS and OMSB multi-stage centrifugal pumps are described in Bulletins 217 and 216, respectively, issued by the Pennsylvania Pump & Compressor Company, Easton, Pa.

TAP MANUAL.—Practical and useful information relative to the construction and methods of employing various styles of taps is contained in the Tap Manual issued by the Morse Twist Drill & Machine Company, New Bedford, Mass. Of particular interest is a section on lubrication. Herein heavy and oil lubricants are described, also their mode of application when tapping cast iron, cast brass, copper, aluminum, etc.

FEEDWATER HEATER INSTRUCTIONS.—The Chapters of Book No. 205, "Instructions for Operating the Coffin Feedwater Heater System," issued by the J. S. Coffin, Jr., Company, Englewood, N. J., contain a description of the function, operation and care of the individual units of the system, a list of operating questions and answers, and diagrammatic drawings showing two locations of the pump —ahead of the trailer and rear of the trailer. Changes and refinements in the equipment have been incorporated in this revised edition, and the subjects of operation and maintenance have been simplified and enlarged upon.

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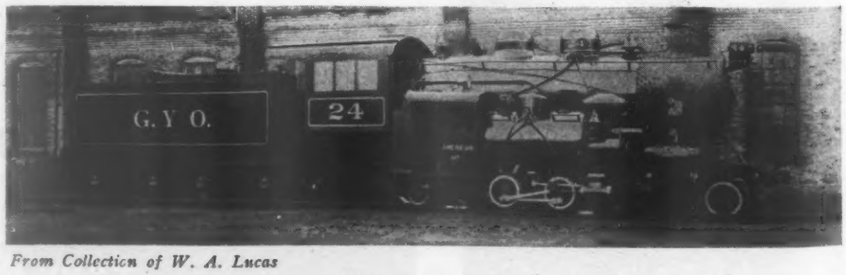

From Collection of W. A. Lucas

A standard-gage freight locomotive for the Guantanamo & Western and a narrow gage plantation switcher for Hawaii—Built at the former Cooke Works of the American Locomotive Company